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Proposed improvement of the waterfront properties of the Central Railroad of New Jersey and the Lehigh Valley Railroad in New York Harbor, south of the Statue of Liberty

A Terminal on the Jersey Flats

AT the present time the railroad terminals along the Jersey shore of the Hudson, opposite New York, are totally inadequate to do the work that devolves upon them. Various proposals have been put forward looking toward extension in one direction or another; and a common feature of them all is the utilization of land now wholly or partially under water—as in Jamaica Bay or on the Hackensack Meadows. A new project is now under way which seems to have features of great attractiveness.

The Jersey Central at present has its main terminus on the narrow neck of land at Communipaw, which juts out into the river south of the Pennsylvania property in Jersey City, and is separated from this by the old Morris Canal Basin. South of the Communipaw peninsula, the map shows that the eastern shore along Greenville and Bayonne recedes from the line established farther north by the Hudson River, so that apparently there is a large arm of New York Harbor in this area between Ellis and Bedloe's Islands, Staten Island, and the Bayonne shore. In reality, however, this area is nothing but mud flats. In places they are exposed for hundreds of yards from the high water line every time the tide goes out; nowhere is there water for commercial purposes.

Perfected plans have now been formulated for a port development project here which is the largest yet undertaken by private enterprise in New York. The improvement contemplates extensive new terminal facilities accessible to all railroads reaching the Jersey shore, with the intensive development for water commerce, coal loading and varied industrial purposes of this vast tract of shoal land which is now idle and worthless. An ultimate expenditure of $200,000,000 is called for in the plans for this most modern of freight terminals covering 1,100 acres. The site embraces land under shallow water now owned mostly by the Lehigh Valley and the Jersey Central roads, and extending from Bedloe's Island to the existing Pennsylvania docks at Greenville. This would include, among other things, the Black Tom pier which made itself notorious a couple of years ago, and the solid-rock reef known as Oyster Island. The detailed plans, formulated after exhaustive surveys, test bores and studies by prominent engineers, have just been taken under consideration by officers of the railroads concerned and are now being subjected to further scrutiny by port transportation experts.

The plan contemplates the creation of wharf frontage which would be roughly equal to the distance from the Battery to 23d Street, exclusive of shipyard frontage to be installed. The reefs of solid rock which rise above low tide in places, and are so great as to baffle removal at a practicable cost, are to be utilized as foundations for multiple-storied warehouse buildings, industrial machinery and drydocks. The improvement would treble the capacity in various fundamental facilities of New York Harbor—in the handling of cargoes, the coaling of steamships, the storage of merchandise and foodstuffs, and the direct transfer of goods from car to ship. In coal storage alone a capacity of 1,200,000 tons is provided for, including space for 8,000 coal cars, with such up-to-date machinery as to afford a close and readily available supply of fuel that would safeguard the metropolitan district against any recurrence of the coal famine of the winter 1917-18.

Chief allowance is made in the plans for those particular facilities of which recent experience has shown the port of New York to stand in most need. First in this category comes the means of handling coal. During the most critical period of the war over 200 steamships were lying in the harbor waiting for coal, while in the narrow inlets along the Jersey shore dozens of coal barges lay with their cargoes frozen solid in them. In the new development the coal-loading plant has been located on the bulkhead along the outer edge of the tract, on deep water close to the main channel, convenient to vessels inbound or outbound. There is space for fifty 500-foot steamers. The most modern fueling facilities in existence are provided for, including elevated running tracks, steel bins with a capacity of 120,000 tons, and traveling towers and cranes capable of delivering coal into both sides of a vessel at a rate of 10,000 tons per hour—faster than it could possibly be stowed below decks. Back of the bins an elongated open area provides storage for 680,000 tons, bordered by mechanical facilities for its rapid reclamation; and in addition there is the track storage space for coal in cars, bringing the total capacity of the plant up to the figure named above.

The most exhaustive provision has been made for the quick and efficient direct handling of cargo between steamships and barges and cars; between steamships, cars and drays; between platforms and stations and warehouses and drays. The unloading platforms are equipped with automatic conveyors, and gravity is utilized to the maximum in all handling. A special ferry terminal, with ample roadways, will give ready access for vehicles to and from any part of the harbor district.

Dire need of greater ship-repair facilities has been demonstrated in the past months, and harbor traffic was seriously impeded during the war by the idleness of a large number of tugs awaiting drydock space. The repair facilities in the new development include berthing space for twelve 500-foot vessels, floating drydocks with 4,000 lineal feet space, and a graving dock able to receive a 1,000-foot ship. The railroad repair shops

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Helium or Hydrogen

THREE times within the last few weeks accidents due to the inflammable hydrogen of the airship have shown with tragic emphasis how imminent a peril rests in the highly combustible gas upon which the lighter-than-air machine depends for its floatation. This epidemic of disasters will inevitably focus attention upon this ever-present danger of the dirigible.

The risk has always been there, and will always be present so long as hydrogen is used as a filler. The first destruction by fire of a large airship of the modern type occurred just before the war, when one of the modern Zeppelins, while maneuvering above the Johannisthal Flying Field near Berlin, fell flaming to the ground with the loss of its entire personnel of over 20 officers and men. During the war and after our entry into it, one of our observation balloons was destroyed by fire, with attendant and severe casualties.

Of the three accidents occuring during the past few weeks, the first, which occurred at Baltimore after the ship had reached the ground, fortunately was attended with no loss of life, the officers and crew having left the ship. The next fatality occurred off the coast of England, apparently during a thunderstorm, and the solitary witness of the disaster reported that the ship suddenly burst into flames and fell into the sea. The loss here was of the whole complement of 11 men. The Chicago disaster was also due to ignition of the hydrogen gas, probably from the exhaust of the rotary engines, the presumption being that some small particles of incandescent material driven out by the exhaust ignited the balloon covering and precipitated the disaster. That the wreckage of the balloon should have fallen through the glass roof of a crowded bank, and spattered its burning gasoline over the employees within a cage from which rapid exit was difficult, is one of those amazing coincidences which seem to set the laws of chance at defiance. Certain it is that this gruesome horror will result in an increasing demand for the passage of well-thought-out laws for controlling the use of the air, particularly over cities and populous communities.

But the outstanding lesson of this series of disasters to hydrogen-supported airships, is that the elimination of hydrogen must be made the constant aim of aeronautical engineers, and of the laboratories which are devoting time to aeronautical research. The wholesale substitution of helium would be the obvious solution, if only that ideal gas could be obtained at a reasonable cost in sufficient quantities to meet the demand. We have no doubt that the aeronautical world would gladly accept the sacrifice of 10 per cent of lifting effect for the sake of absolute immunity from fire. If travel through the air, whether by airplane or airship, is to engage the interest and secure the confidence of the civilian world, so that the carriage of passengers, mail and freight may soon be placed upon a paying basis, it must be made reasonably safe. It is certain that a continued recurrence of these horrible conflagrations will go far to kill the public confidence in travel by lighter-than-air machines.

In view of the growing interest in the possibilities of air travel which has been brought about by the wonderful accomplishment of the NC and the Vickers-Vimy machines, and of R-34, we can think of no field of investigation that should have a stronger appeal for the chemist than that of the production of helium on a commercial scale. Thus far there has been discovered only one source of supply of any magnitude—a gas well in Texas whose yield of helium can supply but a small proportion of the demand which will soon be forthcoming.

The First Dreadnought Design

THE first dreadnought, with its profound influence on naval construction, came very near making its appearance a quarter of a century earlier than it did.

In a paper by Sir Philip Watts on "Ships of the British Navy on August 4, 1914," the author tells of the plans prepared as far back as 1882 for a "Super-Inflexible," which had it been built would have anticipated the dreadnought of 1905 by nearly a quarter of a century. The "Inflexible" was the sensation of her time for the reason that she carried the heaviest armor and the heaviest big-gun battery of that or any previous time. Her compound armor, if we remember rightly, was 20 inches in thickness and her battery was of big guns, consisting of four 80-ton muzzle loaders. Lord Fisher, then a Captain, was in command and Sir Philip Watts was with her on her first cruise, during which designs were drawn up by him and Lord Fisher, who was always a big-gun enthusiast, for an all-big-gun ship, carrying eight 16-inch 80-ton guns, mounted in four 2-gun turrets, one forward, one aft and one on each broadside placed *en echelon*. This gave a concentrated fire of four 16-inch guns ahead, four astern, and eight on either broadside. A truly good showing for the year 1882.

This arrangement was followed about a quarter of a century later in the four battle-cruisers of the "Invincible" type; it was only the size of the proposed ship (16,000 tons) which prevented its adoption at that early date. Sixteen thousand tons, although it is less than one-half the displacement of some of the latest battleships in our own Navy, represented an enormous advance on the size of the British iron-clads of the early eighties.

Had the ship of 1882 been completed the relatively slow fire of her muzzle-loading guns and their lack of range and accuracy, would have rendered them of doubtful value against ships armed with the rapid-fire, breach loading weapons which were about to be carried by the ships of that period. The breach-loading gun was of greater velocity and accuracy and rapidity of fire, and for its weight possessed far greater penetrative power.

The New Jersey Vehicular Tunnel

IT is gratifying to learn that the plans for the proposed vehicular tunnel under the Hudson River at Canal Street are now being worked out under the supervision of a board of able and experienced engineers; but we note with no little amazement that the Chief Engineer is quoted as saying: "The question of ventilation, that has given rise to so much debate, is a negligible quantity." In this he will find himself seriously mistaken. For ventilation, so far as the public is concerned, is the vital question, and to the engineers it should be the fundamental consideration upon which all others stand or fall.

Constant reference is made to the self-ventilation of two highway tunnels under the Thames in London, built many years ago before the era of automobile traffic. There is no authentic information on hand as to the amount of automobile traffic passing through them; or as to whether tests have been made of the poisoned air in them; or how the highway traffic is regulated to make them safe in that respect, if, in fact, they are safe. The subject of ventilation must be approached, as becomes engineers, in a scientific and serious way, and not with mere assertions, based upon superficial tests intended to impress the uninformed.

Whether the tunnel should be built by the shield or dredging method, or by some other method, is of no consequence. No one questions that the tunnel can safely be built by one of several methods. Differences in cost of construction are of trifling importance when compared with the paramount necessity of ventilation, which must be absolutely beyond doubt as to its action.

This tunnel will be different from other long tunnels so far built, in that its purpose and usefulness will depend upon the special provisions made for freeing it promptly and surely from foul air. Thereupon depends the health and, conceivably, the very life of the persons passing through it.

The numerous long tunnels through mountain divides which are used by steam locomotives do not offer the same problem in ventilation. The number of trains passing through them is comparatively small and passengers, shut up in closed coaches during a ride of 12 to 15 minutes, can protect themselves against inhaling smoke and gases without serious consequences to their health, suffering merely temporary discomfort. But the Hudson River tunnel, about 10,000 feet in length, is to be a free passageway for an endless procession of automobiles and motor trucks—it will be possible for as many as 400 to be in it at one time. In this respect the problem of ventilation is absolutely new.

Starting with the computed maximum amount of foul hot gases in the tunnel, the volume of fresh air required for their cooling and safest possible dilution can be ascertained and so also can the rate of removal of the foul air within a given time. The cross section of the conduits for the supply of fresh air and for removal of the foul air, respectively, needs to be so chosen that the cost of operation and maintenance of ventilation shall be a minimum. For this constant and continuous expense must be determined the most economical dimensions of both conduits; also of the ports connecting them with the traffic tunnel along its entire length—their number, size and location.

It may well be that, for the most economical ventilation, the cross section of the fresh air and foul air conduits may have to be larger even than that of the traffic tunnel itself. A balance must be struck between first cost of construction, which may be high and occurs only once, and the continuous cost of operation, which must be low for a given efficiency.

After the respective sections of conduits, ports and tunnels, based upon these principles, have thus scientifically been worked out, there follows the next step, which is to determine how these established cross-sections can be accommodated—whether all three in one large tunnel, or in separate round or square tubes, built side by side. Only after that fundamental question is solved will the engineers be prepared to take up the question of the best method of construction, whether by shield, dredging, McBean method, or any other. The permanent power plant and equipment for ventilation must of course be large enough for the peak load and additional capacity must be reserved for the case of a break down in the operation.

Only when all these things have been determined, in sequence, by careful examination on the basis of computations and estimates, which should be published with the reports of the tunnel commission, can we be sure that the plans for the vehicle tunnel will be adequate and that they will fully meet the purpose for which it is constructed.

Unless the problem is attacked in this logical way, much time may be wasted on irrelevant discussions as to whether this or that method of construction is to be preferred. In the days to come no one will care by what method the tunnel was built, but the public will care a great deal and forever, whether the tunnel can be used without impairment of health and life. The question of ventilation so far from being, as the Chief Engineer would have us believe, "a negligible quantity," is the question which must determine the whole character of the design.

New York Botanical Garden to Train Gardeners

A TWO-YEAR course in practical gardening has been inaugurated by the New York Botanical Garden, in Bronx Park, in order to meet the growing demand for trained gardeners and to help provide careers for convalescent soldiers and sailors. Indoor lectures as well as laboratory work and practical gardening will be included in the course. The garden has an extensive horticultural library, well-equipped laboratories, etc.

Naval and Military

Saving $700,000,000 on Munitions.—At the height of the war Army Ordnance had upon its books about $14,000,000,000 in contracts completed or to be completed. At the Armistice 24,199 contracts had not yet been completed. Had they been carried on they would have cost the Government $6,000,000,000. The Director of Munitions reports that the total claims on these cancelled war contracts, settled and unsettled, will amount to $700,000,000.

Wholesale Destruction of French Railways.—The French Minister of Public Works, in a recent report to the Senate, stated that the Germans destroyed a total of about 3,500 miles of single track railroad; 1,800 miles of narrow gage and local track; 1,500 bridges, culverts, etc., of 12 feet span or over, and 12 tunnels. Most of this destruction was done on the Chemin de Fer du Nord which serves districts such as the Somme, Picardy and Flanders where the fiercest fighting took place.

Alternative Plan for First Dreadnought.—Sir Philip Watts, in his recent paper before the Society of Naval Architects, made known the details of an alternative design prepared by Admiral Fisher for the first dreadnought. She was to carry 12 12-inch guns in six 2-gun turrets, all mounted on the center line of the ship, there being three at each end of the vessel mounted closely behind one another and at successively higher elevations, so that each pair of guns could fire over the roof of the turret ahead. This would have given a concentration of six guns ahead and astern and 12 on either broadside.

A Battleship Costs $32,000,000.—The Navy Department estimates that the two super-dreadnoughts for which bids were recently received, will cost with armor and guns a total amount of $32,000,000. These are ships of the 1916 program, and they show an increase in construction cost during the war of nearly 100 per cent. The increase has been progressive, with a big jump, of course, during the past five years. Thus the "Alabama" (11,565 tons) of 1900 cost $2,722,000; the "Connecticut" (16,000 tons) of 1906 cost $4,096,000; the "Florida" (21,825 tons) of 1911 cost $6,400,000; and the "Nevada" (27,500 tons) built in 1915, cost $11,000,-000.

German Railway Equipment for the Allies.—Thanks to the provison in the Armistice calling for delivery by Germany of 5,000 locomotives and 150,000 freight cars, a considerable proportion of the railway equipment in Belgium and Northern France is of German manufacture. The locomotives were to be delivered in good order and were to be accompanied by spare parts. The American inspection by the engineers of our Army of Occupation was discriminating, if not severe. Of the total of 8,383 cars inspected our engineers accepted 6,717 and rejected 1,666. The locomotives did not fare so well, for out of 225 inspected by our officers 143 were rejected and only 82 accepted.

Ten Thousand Yearly Railroad Casualties.—The Interstate Commerce Commission quarterly accident bulletin of March 31st, 1919, showing the railroad accidents in the United States for the third quarter of 1918, states that in train accidents 348 people were killed and 2,147 injured. If that rate prevailed for a whole year, it would result in a total of 1,392 killed and 8,538 injured. For a period of 17 months, which was the time we were in the war, these railway accidents would produce a toll of 2,088 killed and 9,980 wounded, which means that for every 24 United States soldiers killed during the war, the United States railroads alone killed one citizen. Government control of railroads evidently is as dangerous as it is extravagant.

Naval Rivalry Deprecated.—In its leading editorial a recent issue of the *Naval and Military Record* speaking of the future development of the British Navy said: "The German fleet has disappeared . . . and the only foreign power which has augmented its Navy upon a large scale is the United States. In these circumstances it will not be easy to hit upon a working formula to represent our minimum needs. . . . We might of course base our future building programmes on the corresponding efforts made by the United States, but the objection to such a course is that it would imply a rivalry in armament between the very Powers on whom the world relies to prevent fresh wars. Few people in this country would approve of a naval policy which could in any sense be interpreted as a threat to our friends across the Atlantic."

Science

Fish to Destroy Mosquito Larvæ.—A long series of experiments was made last year by Mr. S. F. Hildebrand, of the Bureau of Fisheries, on the use of the top minnow (*Gambusia affinis*) for destroying the larvæ of mosquitoes in ponds. This investigation was carried on at the request of the Public Health Service as a part of the antimalarial work in the extra-cantonment zone of Camp Hancock, Ga. In his recently published report on the experiments, Mr. Hildebrand states that this species of fish is especially suitable for antimosquito work because (1) it seeks its food at the surface; (2) it is very prolific; (3) it gives birth to well-developed young, therefore requiring no special environment for depositing and hatching the eggs; (4) it lives and thrives under a great variety of conditions and frequents areas especially suitable for the support of the mosquito larvæ; and (5) it usually lives and multiplies in ponds stocked with predacious fishes, provided it has very shallow water for refuge. Mosquitoes may, however, breed in water so badly polluted that *Gambusia* is almost instantly killed thereby.

Climbing Fish.—An interesting account of the climbing catfish of Colombia (*Arges marmoratus*) was published a few years ago by Mr. R. D. O. Johnson. These fish can climb, by means of suction apparatus, not only up the steeply inclined bed of a mountain torrent, but even up a smooth vertical surface. Mr. Johnson saw some of them climb a vertical distance of 18 feet in half an hour, up a wall of rock over which trickled a thin film of water. In connection with a recent republication of this article in *Natural History*, Mr. G. K. Noble states that other species of fish are known to climb in the same manner. Several of these occur in the Himalaya. *Nemachilus rupicola* and perhaps other species of mountain cyprinids adhere to the rocks by means of their smooth ventral skin and enlarged lips. The silurid genera *Pseudecheneis* and *Glyptosternum* cling by means of a well-developed abdominal sucker. The mountain torrents of the Himalaya form the nursery for many species of frogs. Their tadpoles, like the fish, have become adapted to their location; some cling by means of their lips and ventral musculature, while others possess a well-developed ventral sucker.

Valuable Methods of Combatting Diphtheria.—The New York City Health Department was one of the pioneers in the introduction of diphtheria antitoxin into this country. The same department is now much interested in securing the general adoption of two other measures for the control of the disease. One is the Schick test, for discovering whether persons are susceptible or immune to diphtheria, and the other is the active immunization of susceptible persons by means of toxin-antitoxin mixtures. The Schick test consists in injecting, intracutaneously, a minute quantity of diphtheria toxin. If the subject has not sufficient antitoxin in his blood to constitute immunity, a small local inflammation follows; otherwise the skin remains normal. The negative reaction shows that a person need not take antitoxin treatment in case he is exposed to diphtheria, and it is said that the use of this test would save a large amount of antitoxin and the unnecessary sensitization of more than 65 per cent of exposed individuals. It should, therefore, prove a boon to the health authorities during a diphtheria outbreak. The process known as "active immunization" is said to confer immunity from the disease for at least three years and probably much longer; whereas the immunity due to injections of antitoxin does not last more than three or four weeks. The immunity conferred by the new process does not, however, develop until the lapse of from two to twelve weeks, and so is not appropriate for the use in the case of persons recently exposed. The dose consists of a mixture of diphtheria toxin-antitoxin, and three subcutaneous injections are given, at weekly intervals. In New York City diphtheria still causes 1,000 deaths per annum. Dr. W. H. Park, who has made extensive investigations with the Schick test, finds that the susceptibility of the population to diphtheria rises with age from 15 per cent for infants under three months, up to a maximum of 70 per cent between one and two years, and then diminishes to 15 per cent for persons over 20 years of age. Ample details concerning the very important matters set forth above will be found in Public Health Reports for May 16th, 1919.

Electricity

Interesting Application of Heat.—A recent issue of the *General Electric Review* describes a method of heat shrinking for fitting parts of electrical machines on to their shafts. The method overcomes various difficulties experienced with press fittings. Water or steam heating is used for flywheels and couplings, while for armatures and field systems conveniently situated heating resistances answer the requirements. In one case mentioned, *i. e.*, a large armature, the shaft was 35 inches in diameter. Cold pressing would have required a maximum pressure of 600 tons. By heating the armature to about 80 degrees C., however, the shaft could be pulled on with a five-ton chain hoist.

A Record Daytime Load.—The New York Edison Company had to meet the largest demand in its history as a result of a sudden storm which struck Manhattan Island a little after 4 o'clock on the afternoon of June 20th, according to *Electrical World*. A heavy fall of rain and a thunderstorm brought the darkness of night to parts of the island. Shortly after the storm broke the stations, which had previously been generating about 250,000 horse-power, were called upon to supply a demand increased to 425,000 horse-power. The change in suddenness, percentage and magnitude was without precedent in the history of more than thirty years, yet every part of the system met the exigency without failure.

An Electric Bell with Triple Tone.—Three separate and distinct sounds are given by an electric bell which operates on ordinary lighting current by means of a transformer. In the home the bell can be connected with push buttons installed at three different doors, front, kitchen, and side, for example. When one button is pressed a clear ring results, when the second is operated a buzz is produced, and when the third button is pushed a combined buzz and ring results. In the office or shop this bell will prove most useful since it can be used to call three different persons without necessitating them to count the number of rings, as must often be done when the customary signaling system is employed. This bell has no contact points to burn out, no batteries to replace.

Nauen Wireless Time Signals.—In a recent issue of *Zeitschrift fur Instrumentenkunde*, a device is described whose operation is initiated by a single current impulse. This impulse actuates an electromagnet and sets a pendulum free. The pendulum in its swings causes a disk to rotate in jerks, following the swings of the pendulum. On the edge of the disk projections are provided that make a series of contacts by pressing against the tongue of a spring, and these contacts control the signals. After the series of time signals has been given in one revolution of the disk, a cam on the disk closes a second contact, which causes a second electromagnet to be energized. This electromagnet releases an armature that catches the pendulum and arrests it ready for its release for the first electromagnet at the succeeding time signal.

Electrically Heated Clothes for Airmen.—The extreme cold encountered at the higher altitudes makes it necessary to provide electrically-heated clothes for airmen, at least in the instance of most military machines which offer no protection to the passengers. The energy required to heat these suits is generally around 80 watts, disposed as follows: Helmet, 20 watts; each glove, 16 watts; each moccasin, 14 watts. The energy is supplied at 12 volts, either from a storage battery or from a small fan-driven generator of streamline shape mounted on the airplane, the fan being rotated by the passage of the plane through the air. The heating elements are flat loops of resistance wire spaced about seven per inch and about 9/32 inch wide per row. They are machine-sewed on a cotton cloth base, the cotton thread being carried along the top and bottom of each row of loops parallel to the horizontal axis of the row. Flexibility results from this mounting, and the base can be stretched or crumpled at will without danger of breaking the wire. Each heating element is composed of two bare wires in contact with one another throughout a considerable part of every loop, so that if a break occurs in any one wire, the effect is merely to force the small amount of energy concerned through a conducting path of smaller cross-section between the break and the near points of contact.

The Tenth Anniversary of the World's Military Aviation

Looking Back at 1909 When Our War Department Secured the First War Airplane and Enthusiasm Was Worldwide

By George W. Sutton, Jr.

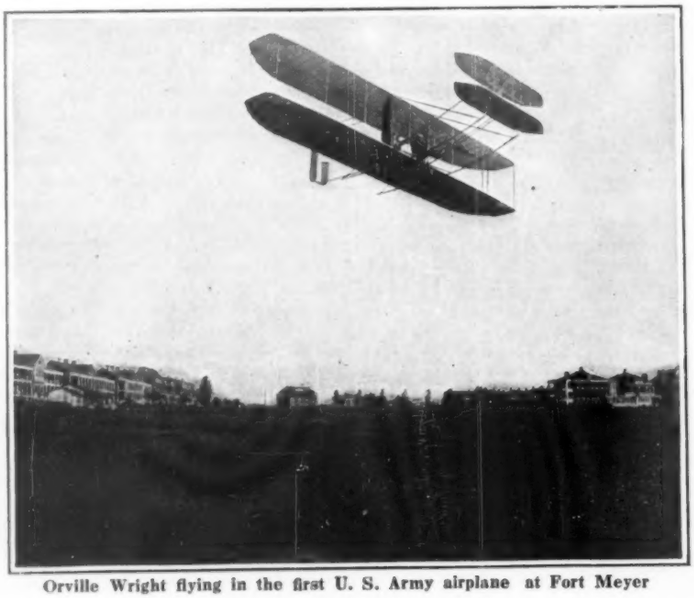
EXACTLY 10 years ago, on July 30th, 1909, the United States became the proud possessor of a military airplane. No one knew just what to do with it, but it was there all the same.

On that day, Orville Wright and 1st Lieut. Benjamin D. Foulois, completed, at Fort Meyer, the final official trial flight of the Wright airplane contracted for by the Government—a 'cross country trip of five miles in each direction, with and against the wind. The speed was 42 miles an hour, which won a bonus of $5,000 over the contract price of $25,000. Three days before, the endurance figure of one hour was exceeded by 12 minutes, 40 seconds when 1st Lieut. Frank P. Lahm was the passenger, the first American army officer to fly.

So it came about that 10 years ago we had the world's best airplane but no pilots. Later, when war came, we had pilots but no airplanes. The honor of being the first power to have the nucleus of an air fleet was, however, hardly the result of premeditated sagacity.

In January, 1904, the American daily papers carried a statement from the Wrights of their successful flights on December 17, 1903—the first power flights made by man. No one seemed to believe.

In the same year the Wrights themselves caused a proposition to be placed before the Government, offering the whole works for $100,000—their tables and figures, the proposed patent and a real airplane—all dependent upon the latter's actually demonstrating that it could fulfill requirements precisely the same as those by which the Government finally did acquire the machine alone five years later. Here was America's chance to become the leader in flying and to give the secret of flight to the world. But did we seize the opportunity? No; with customary apathy we did not.



Orville Wright flying in the first U. S. Army airplane at Fort Meyer

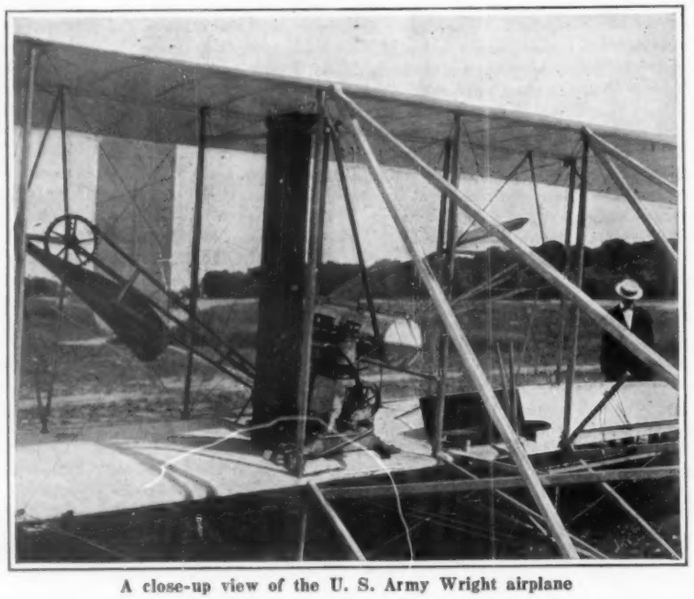
The matter was turned over to the Board of Ordnance and Fortification, which replied in the same doubting phrases the War Department uses to this day when anything new is suggested, and added that, anyway, it had not that much money to spare for such a purpose. To those who have wondered how we ever changed from war canoes to battleships and from bows and arrows to rifles, the following will be an interesting and typical example of the mental processes of those who are handling these matters for us.

The publication in 1905, in a foreign aeronautical journal, of an account of the Wrights' flights from 1903 to 1905, aroused no enthusiasm in our War Department. But it caused a big sensation in Europe and started renewed experimentation at a time when a discouraged lethargy prevailed among Continental aerial locomotive dreamers.

Nor did the announcement by the American Aero Club in 1906, after investigation and interviewing witnesses of flights, inspire any official action by our Government. The French authorities, however, were more keen and sent over a Major Bonel, who visited Dayton in 1906 and satisfied himself of the truth of the Wrights' statements that they had flown. Nor was Germany blind to the possibilities of the airplane, for in October, 1906, Captain Hildebrandt, student of aeronautics and author of works on the subject, investigated the claims of the Wrights. He talked with witnesses of the later flights of 1904 and 1905 at Dayton in the presence of townspeople. And he said: "The age of the dirigible balloon has been broken." He expressed the opinion, in view of the secrecy maintained by the Wrights, that the machine itself was so simple that a purchaser could not be found at the price asked, were it exhibited. "Furthermore, I am inclined to think it requires great skill to handle the machine . . . I am of the firm belief that a sum as high as 4,000,000 marks will not be required if we entrust German engineers and aeronauts . . . with the solution of this problem. Surely we will not have to be behind the American inventors." Isn't that typically German? Neither Bonel nor Hildebrandt saw the machine.

These visits were noticed by an individual in private life and, in the course of time, as a result of his interest, the Board of Ordnance and Fortification deigned to address a letter to the Wrights, asking them to submit a proposition. The Wrights asked what specifications would be required. The Board had nothing to suggest and its interest seemed rather perfunctory. At any rate, the Wrights reiterated their willingness to deliver a machine, which would do certain things, for $100,000, but nothing eventuated.

This apathy toward the airplane on the part of the Board of Ordnance and Fortification may have been partially excusable. It was not so long before that it and the War Department had been bitterly attacked in Congress for spending money on Langley's eventually successful man-carrying flying machine, when Dr. Langley was characterized as "a professor wandering in his dreams" and the official permitting the expenditure as "hypnotized." This attitude toward aviation is still noticeable in Congress and is allowing France and England to take such a lead in this respect that we shall have great difficulty in ever catching up.



A close-up view of the U. S. Army Wright airplane

A group of aero enthusiasts in New York approached the Wrights in 1906 and proposed to buy the patent, but the necessary funds failed of securement.

In the winter of 1906, negotiations were started to sell the Wright machine and patents to foreign governments and syndicates, and curious stories were printed as to alleged demands, prices wanted, conditions and so on. As is well known, these efforts met with success.

It would appear that our military attachés were attracted by these operations abroad, for, in 1907, the War Department suddenly evinced a real interest and this time opened communications itself. Orville Wright has since said that when they first broached the matter to the Government money was not the main consideration and that, despite the bareness of the Ordnance and Fortification cupboard, he was sure satisfactory terms could have been made. When the early proposals had been made to the Government and to the American Aero Club that for $100,000 patent applications would be dropped and the world could have the invention as a gift, the Wrights had in mind the possibility of the trials and tribulations of patent litigation. They were modestly willing to be satisfied if they could reap some small return on their investment of brains, money and time.

But the obstacles they encountered later changed their attitude and made them determined, if possible, to enjoy the full fruits of their labors. They finally concluded negotiations in England, France, Germany, Italy and America but they were not able to avoid the hated lawsuits in any land but Italy. To this day the end of this litigation has not been reached. Wilbur Wright died May 30th, 1912, while the suits were in full swing.

In the fall of 1907, after foreign negotiations had met with success and the Wrights had returned to America to build machines with which to demonstrate their claims, Wilbur Wright stopped off at Washington and as a result of an interview at the War Department caused the Chief Signal Officer, General James Allen, to make public on December 23d specifications for a gasless flying machine—the first specifications of the kind ever issued.

The salient features were the following demands:

Assembly in one hour.
Transportation in army wagons, disassembled.
Carry two weighing 350 pounds, with sufficient fuel for 125 miles.
Speed 40 miles per hour 100 per cent; with penalty and bonus of 10 per cent per mile per hour below or above 40 respectively.
Capable of steering in all directions and at all times under perfect control and equilibrium.
To be provided with some device to permit of a safe descent in case of an accident to the propelling machinery.
To be sufficiently simple to permit an intelligent man to become proficient in its use within a reasonable time.
Price to include instruction of two men.

The only American aeronautical journal in existence, *Aeronautics*, complained of the severity of the conditions. It also worried about the probability of instilling sufficient knowledge into two men to make successful aviators of them.

The New York *Globe* said that from the announcement of the Government "the era of practical human flight" had arrived but the rigid specifications proved "this assumption a delusion. A machine such as described in the Signal Corps' specifications would record the solution of all the difficulties . . . and give mankind almost as complete control of the air as it now has of the land and the water. It would be worth to the world almost any number of millions of dollars . . . If there is any possibility that such an airship (sic) is within measurable distance of perfection any government could

well afford to provide its inventor with unlimited resources and promise him a prize in case of success, running into the millions."

But the Government saved $970,000 and got a machine which eclipsed the most sanguine hopes. The Board of Ordnance and Fortification, strangely enough, allotted the funds which made possible the contract with the Wrights, Congress having failed to authorize the 1908 aeronautical estimate of $200,000.

Twenty-two bids in all were received within the time limit. This is the first time they have been published. They were as follows:

Geo. W. Schultz....	$30,000	A. M. Barker.....	$850
Brown & Swingle...	5,450	A. E. Moline.....	1,389
R. G. Dressler.....	5,000	E. H. Young.....	5,000
O. M. Preston.....	20,000	Jno. M. Kairies....	30,000
A. F. P. Stenzy....	10,000	Fred C. Schwartz...	10,000,000
W. R. Gordon $40, $65 per pound	$50 and	Wm. Harper, Jr....	20,000
		Frank & Hedden Co.	500
L. J. Brown.....	15,000	Chas. B. Nichols...	52,568
John F. Cavanaugh.	55,000	A. W. H. Grieppe..	25,000
J. J. P. Boatman, 7,000 per ton lifting capacity, 1-10 tons		James F. Scott.....	1,000
		A. M. Herring	20,000
Chas. M. Wanzer...	$1,000,000	Wright Brothers....	25,000

One bidder stated his machine would sustain itself in the air without any machinery whatever and ascend from any ordinary place in calm or storm. Only 30 days were required by one man to deliver his machine, while another thought five years ought to be allowed, as it was a big undertaking, this first production of something the world had never seen. One of these, whose bid was extremely low, set forth his specifications simply, as follows:

"Speed 100 miles per hour (arc planes silk, aluminum bands, steel wires and paper). Surface of airplanes two 7 x 11 feet, three ground wheels, two guyre scope wheels, one blower, speed 1,000 revolutions per minute, engine and everything complete, ready for flight with two men, 700 pounds."

Another offered an "airship carrying 15 men at a speed of 40 miles an hour, fuel for 3 days, with a 25-horse-power motor." This is rather better than the record up to 1919, but, as the bidder wrote on his bid, "Bei Gott sind alle Dinge meglich."

Of these offers three were accepted:

Wright Brothers	$25,000
A. M. Herring's.....	20,000
J. F. Scott's	1,000

None of these bidders save the Wrights have ever flown power machines, so far as is known, and only one airplane was ever delivered for test, though A. M. Herring obtained several extensions of time. Scott was not awarded a contract.

The Wright flights of July 27th and 30th, 1909 were not the first, however, under the contract, for on September 30th, 1908, official flights were begun at Fort Meyer, near Washington, to fulfill the conditions imposed in the contract. The sad death of 1st Lieut. Thomas E. Selfridge, the passenger, and the serious injury to Orville Wright, the pilot, as a result of a 75-foot fall during one of the trials, postponed further flights for that year and necessitated a nine months' extension of time. The death of Lieutenant Selfridge, whose monument may be seen at Arlington Cemetery, was the world's first airplane casualty.

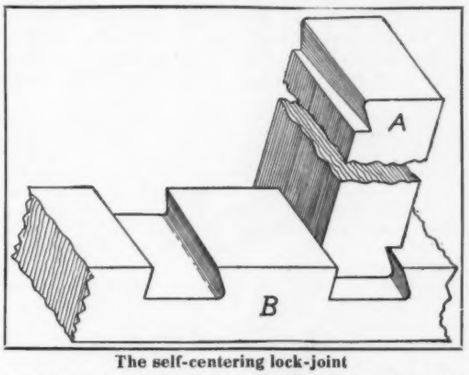
While Orville was starting his flights in the Army airplane in September, 1908, Wilbur Wright was flying in France. On the last day of the year he made a record of 77 miles in 2 hours, 20 minutes, which stood until August, 1909.

After the delivery of the Army airplane on July 30th, 1909, Orville Wright went to Germany, where a company had been formed similar to those in France and England. Wilbur Wright remained to teach the United States' first Army fliers, 1st Lieutenants Frank P. Lahm and B. D. Foulois.

In addition to the formation of the world's first military aviation force, there are some other reasons why July, 1909, should be remembered in the flying world. Bleriot, the lamp manufacturer; the automobile racing driver, Henry Farman; Hubert Latham; Delagrange; the airship mechanic Louis Paulhan, and Roger Sommer were daily making new individual records in France, though none yet equal to the achievements of the Wrights. Colonel F. S. Cody, an American of the British Isles, was making short hops in England as was A. V. Roe, originator of the now famous Avro training machine.

On July 25th, Bleriot made the first airplane crossing of the English Channel from Calais to Dover, in his own famous monoplane—31 miles in 40 minutes. Latham made his second attempt to cross the channel on July 27th and for the second time landed in the water, though within two miles of his goal.

Glenn H. Curtiss, on July 5th, was flying for the benefit of the citizens of New York at the world's first open air meet, at the world's first club aviation field, on the old Morris Park racetrack, which had been leased by the Aeronautical Society, organized to give embryo fliers a place where their machines could be built and tried.

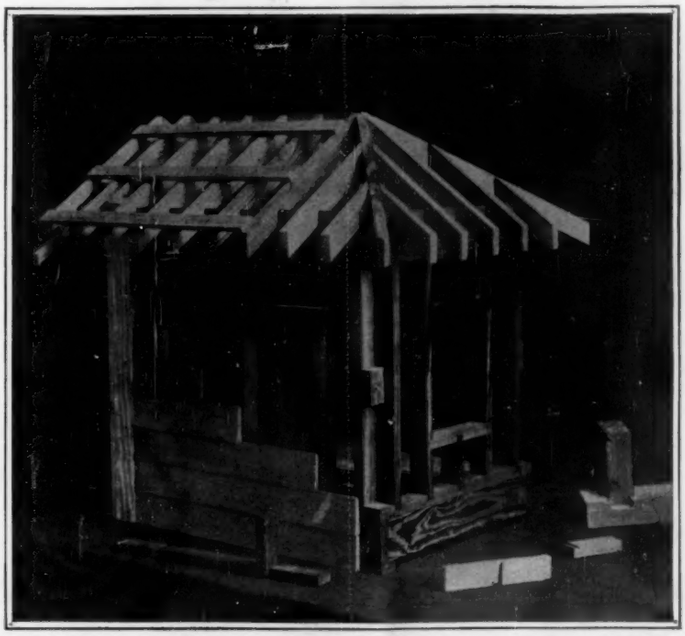


The self-centering lock-joint

A, Joist or stud. B sill or plate. The tenons are oppositely faced at the ends of the joist or stud. This obviates any right or left so that either end will fit into the designed mortise.

Charles F. Willard, the airplane manufacturer, began his career in 1909 and it was at the Aeronautical Society's field that he built his first plane. It was unfortunate that this was too big to be got out of its shed on the day of the exhibition but that was the fault of the shed.

In this month Curtiss forever established his reputation as an airplane pilot when, on the 10th, he flew 52 minutes and covered 25 miles in the Aeronautical Society's airplane at Mineola, his longest flight to that date. The previous year on the 4th of July he had won the SCIENTIFIC AMERICAN trophy by making a flight of a little more than a mile in his biplane the "June Bug" and the 25-mile flight gave him the trophy for the second time. The next year by a flight of 74½ miles without stop he came into permanent possession of the cup. It might be appropriate to mention here that while the Wrights were delivering their first Army airplane to a world power, Curtiss was delivering the first commercial machine of record to the Aeronautical Society which had been contracted for the year before while Curtiss was experimenting in Hammondsport as a member of Dr. Alexander Graham Bell's Aerial Experiment Association.



Model of a section of standardized construction consisting of elements of definite dimensions which can be assembled with one-third the usual number of nails. Only one tool is required—a hammer

After his 25-mile flight, Curtiss started on the instruction of Charles F. Willard, one of the society's members, who, under the terms of the purchase order, was one of the two selected to be taught the art of aerial locomotion. Thus was inaugurated the first flying school in the world.

All over the United States there was great activity. Every youth of mechanical trend of mind was reading the few aeronautical magazines of the world and building airplanes of his own or some one's else design. There was a demand for aviation motors which no one could supply, not even Curtiss.

Many old timers in aeronautics have dropped out and gone their unknown ways and some have died in traveling the new way. Others have continued, of whom many have achieved prominence. Lieutenant Foulois, now Brigadier General, was the first Chief of Air Service of the American Expeditionary Forces; Lieutenant Lahm, as Lieutenant-Colonel, was Chief of Air Service of the Third Army, A. E. F.; Major C. McK. Saltzman is now Brigadier General.

Colonel C. deF. Chandler, head of the Balloon Section of the A. E. F., was the first Army dirigible pilot and one of the very earliest officers to learn to fly the Wright airplane. Major George O. Squier, the second United States officer to have a flight in an airplane, is now Major-General and Chief Signal Officer. These men were on the aeronautical board which accepted the Army's first plane. Colonel T. D. Milling, Lieutenant Milling in 1911, when he was one of the army officers detailed to learn to fly the Wright, was Chief of Air Service of the First Army A. E. F., Colonel H. H. Arnold, also a member of the first group to learn to fly, was assistant Director of Military Aeronautics in Washington during the war.

Curtiss, Willard, Wright, Burgess, Seely, Kirkham, Leo Stevens, Glenn Martin, Spencer Heath and other old-timers have all done big things in the recent tremendous development of aviation. They and their successors may be counted upon to stick by the ship until commercial aviation becomes profitable, regardless of what Congress may or may not do.

Fabricated Lumber and the Housing Problem

By Robert G. Skerret

THE housing problem is countrywide in its reach. If the estimates of the various authorities be correct, there are several hundred thousand families in this land of ours who cannot find the accommodations they desire or to which they are accustomed. This seriously menaces our whole social fabric, because it makes for unrest and unquestionably cuts down the efficiency of our citizenry.

To make matters worse, the price of labor has recently been raised a substantial percentage. Similarly the cost of structural materials is mounting more or less in proportion. How, then, can the situation be met without imposing a needlessly heavy tax upon all concerned? Has American ingenuity anything to offer in the way of immediate relief? Is there anything distinctly novel in house building which will help measurably to meet the present need and also offset hereafter the higher prices which we are informed are likely to prevail for years to come?

The structural steel worker—and this incidentally includes the designer or architect—has been achieving many of his amazing results in the last decade or so by reason of the standardized materials turned out at the steel mills. Going a step farther, these plants have cut and prepared their plates, angles, beams, etc., so that only a minimum of labor would be required to assemble these units at the building site. In a kindred way the fabricated ship has come into being. Why, then, should standardized lumber parts not find a corresponding and helpful field of usefulness? Native genius has answered this question in a thoroughly practical fashion.

Engineering cunning and practical experience have come to the rescue in the shape of cut-to-length lumber which is so cleverly machined at the economically-located saw mill that the finished products can be assembled with a marked saving in time and outlay. Not only that, but, within some limits, the house builders can be recruited from the very commonest of laborers. The significance of this becomes clearer when it is borne in mind that the first-class carpenter, so the experts say, can cut, trim, and nail or

(Continued on page 117)

Who Shall Do the Work?

A Study of the Present Situation with Regard to Common Labor

By R. D. La Guardia

AT the present time there is evident a very great tendency on the part of America's foreign-born residents to return to their native lands. Whether they will ever retrace their steps a second time to America is doubtful. This presents a serious situation; for it is obvious that, were it not for the army of six million or more foreigners doing the dangerous, unsanitary, ill-paid work in American subways, tunnels, mines, etc., it would go undone. The average American refuses to do it, and refuses to live on the scale necessitated by the wages paid those who do it.

If these people go away and never come back, we shall suffer a great loss in the labor needed to carry on our constructive enterprises of readjustment, to supply post-bellum needs of materials, and to do the ordinary manufacturing of ordinary national existence. As a necessary consequence, we shall suffer seriously throughout our social fabric.

There are several reasons why the return to America of the emigrating immigrants is at best doubtful. In the first place, the governments to whose jurisdictions they are returning will likely enough restrict their departure to other lands for some years to come; there is in these countries a need for labor fully as great as ours. In the second place, a goodly number of those leaving our shores are going back to the promised land of a liberated Poland or Czecho-Slovakia, filled with patriotic ardor to be of service to their newly arisen native countries. There is little hope that we shall ever get these people back. Of the Italians, on the other hand, more are going home merely to spend the competency acquired in America; some of these will return if permitted.

The extent to which there will be new immigration to America is an open question. The non-family foreign laborers who show always the greatest desire eventually to return whence they came, are from all parts of the world; but more than from any other single source they are from the Balkans. Slavs, Greeks and what not come to America to secure money for their immediate wants, for the enlargement of the little estate back home on which their future generations are to live, and for the general increase of the prosperity and happiness of the home left behind them. Before the war, Balkan Europe had been so largely rehabilitated from this source that there was a large decrease in the supply of labor from that source. The money returning by mail or in the pockets of men who were severing their American relations had already reached the estimated total of from $300,000,000 to $600,000,000. Even after the drain of four years of war, these countries are in better shape financially than when their uplift with American money started. And let it be emphasized that the man who comes here from southern Europe to build up his fortunes is no hog; when he gets what he considers a sufficient stake to set him up in the old country, back to the old country he goes.

Among the people directly affected by the war are the Bulgarians, Serbians, Greeks, Macedonians, Montenegrins, Albanians, Armenians and others. To these people the argument of the preceding paragraph applies; and in addition, there is the big fact that for them there is work to be done at home. Similarly the Croatians, Hungarians, Rumanians, Dalmatians, Bosnians, even the Slovaks farther north and still more remotely the Russians, will be not a little influenced to remain at home for some time as a result of the war. Those who are at home will stay home and cut down the normal volume of arrivals at American ports; those who are here will leave for home and further diminish the visible supply of unskilled labor.

If we wish to avoid the serious results of this tendency on the part of European labor to stay away and to go away from America, we must make America more attractive for that labor. In some directions it would be no exaggeration to say that we must make it more tolerable. Housing by all means must be made more sanitary and more comfortable, and there must be some abatement of the excessive rentals asked and secured for unworthy houses. We must accept the principle that the children of these people shall become of us as well as among us. The adult foreigner asks little for himself. Give him a decent home and he is content. He shrinks from the difficult task of making a place for himself in the English-speaking community. But for his children he demands the best that America has to offer; and when he does not get it he finds advantage in taking his family away from America.

The large percentage of foreign-born children and youths in our Juvenile Courts, our Reform Schools and our other penal institutions is a crying commentary upon the reception which we extend to the foreigner when he brings us valuable labor. We take his labor, giving him as close to a starvation wage in exchange as we can prevail upon him to accept; then we teach his children to become criminals, and shut them up for practicing their instruction.

We must encourage the European laborer to come to this country and to remain here by adopting an entirely different procedure. The day is past when he will come anyway for the sake of the wealth we have to offer him, putting up with our treatment in order some day to go home rich. And as it is quicker and more effective to keep what we have than to secure a new supply, the problem of retaining what is left of our foreign laboring population is the pressing industrial requirement of the hour. If we fail in our efforts to solve this problem, it will be necessary to look for a new source of supply for our laboring class. And as every section of Europe has already been drawn upon, another part of the world must be found from which workers may be secured.

A ship-load of immigrants emigrating to their native lands

Of course in any such effort we must confine our attention to those dwelling in temperate climates. There are 400,000,000 Chinese under this head; there are 40,000,000 Japanese, of whom at least five millions are ready to come to this country for a few years if we will have them; there are a quarter of a billion Hindoos, people poorly adapted physically and mentally to heavy work. There is a possibility that the legislative barrier against the use of labor from these sources will be withdrawn if the demand for labor becomes sufficiently acute to warrant such a departure from long-standing policy. But it is doubtful that these people could ever prove satisfactory substitutes for Europeans; and in any event their coming would constitute a far more serious problem and lead to far more serious complications than has been the case with the coming of white men from Europe.

In the first place, the question of friction along the Pacific Coast would have to be dealt with. This section of the United States says that it has had its experience with Oriental labor, and found it bad; that it wants no more of it. If this difficulty could be smoothed out, there would still be the necessity for rearranging steamship service to take care of the proposed influx, and to carry on the increased business with the East which would result from the presence of millions of the children of the East on our shores. Transcontinental traffic might have also to be entirely recast in the same mold.

Again, immigrants from Asia would be neither Jewish, Protestant nor Catholic. They would in no way be so rapidly susceptible to American influences as are the Jewish and Christian peoples from Europe. Our religious and moral life is sufficiently vexed as it is, without the superposition of this extraneous complication upon it. Under such an arrangement, the spectacle of Chinatown in all its native squalor and licentiousness would be found in all our American cities, with its depressing political and commercial effects. We want no floating millions of Asiatics without families; we have no room for a Singapore or a Shanghai in the United States. Above all there is no place in America for millions of residents who can never become citizens.

These are the facts and the problem is clear. There is urgent need for every large industry to get busy and plan for a permanent program enabling it to choose the desirable European over the undesirable Asiatic. Readjust the work, and the demand for unskilled labor will be felt more than ever. Hence every industry must be prepared to attack the problem from the side on which lies the true solution.

Make life comfortable for the foreigner in America; teach him American ideals; make him feel that he is a necessity in this country and that the country is a necessity to him. Above all, Americanize him by teaching him our language. The fear that if educated he will refuse to do the unskilled work, but will rather demand promotion to higher and responsible positions, is a mistake. If he finds such promotion open to him, he will not fail to write to his brothers, his cousins and his friends that America is a land which offers equal opportunities to all. And they will come, and start at the bottom, just as he did; for whatever bad traits may in prejudice be imputed to the European laborer, no one can say that he is not willing to work; and he will cheerfully begin at the bottom, even though many of his friends are already arrived at the top.

But on the other hand, if neglect is shown him, as in one instance where a man working in a New Jersey industry for 30 years is still unable to sign his name, the foreigner will return to his home in disgust when he conveniently can, carrying and spreading the opinion that America is for Americans only. He will repeat the story broadcast; and, the pity of it, it will be true.

Every country of Europe affected either directly or indirectly by the war has already accomplished a comprehensive program of national reconstruction, including not only industry but also health and education. There is no reason in the world why America should not do the same thing, on a much larger scale. It does not matter where industrial difficulties arise, it is certain that all countries will be affected. The war, if it proves anything, proves that no longer can any man or any nation live to himself or itself alone.

May it then be finally decided and authoritatively put into effect that when a foreigner renounces his allegiance to his old country, he by so doing becomes an American—not only on the day of his voting, but on all days and in all circumstances. Let us avoid as we would fire, the tendency to have an Italian district and a Syrian district and a Rumanian district. Let us cease moving out of a given neighborhood *en masse* when our fellow citizens of foreign birth begin to move in.

These are but a few of the many concrete phases of the problem. As soon as labor and capital, as soon as one nationality and another, learn to get away from perilous abstractions and come right down to concrete things, the problem will be in a fair way of solution.

We are all human beings, and if we will, we can all look beyond the circumstances and the emotions that divide, and attend to the sympathies that unite. Make of our foreign-born workers welcome members of the community instead of unwelcome intruders, and the vexatious problem of a labor source will have been solved.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Our High Prices—Have They Come to Stay?

We publish below a letter received from Mr. Hugo Bilgram. In view of the importance of the subject, we also append a reply in which Dr. Alfred J. Lotka, the author of the article recently published in our columns, explains the points which have given difficulty to Mr. Bilgram and possibly to some other of our readers.—EDITOR.

To the Editor of the SCIENTIFIC AMERICAN:

It is regrettable that an obvious fallacy in the theory of prices is continuously reiterated, namely that the purchasing power of the dollar is determined by the demand for money divided by the product of its supply and the velocity of circulation.

Under the above heading Alfred J. Lotka, in your issue of July 5th, elaborates this law by assuming that a total product of $1,000,000 of gold were in circulation, that each dollar changes hands 25 times each year, and that the total yearly traffic of goods amounts to a billion pounds of a certain commodity. He then concludes that the price per pound will be 25-1,000 of a dollar, or 2½ cents. He then argues that if the amount of gold in circulation were doubled, the price of the commodity per pound would be just twice what it was before.

It is difficult to see by what process of reasoning this conclusion is obtained. The error is perhaps to be traced to the fact that the word Money is generally used in a double sense. It is said to be a medium of exchange and a measure of value. These two concepts are radically different, hence it is illogical to assign one word to cover both. If the word Money is used to designate "medium of exchange," it cannot also be used in the sense of "measure of value." The dollar is our unit of value, and to call it a "money unit" is as meaningless as it would be to call our yard a rope unit or our pound a sugar unit. The dollar consists of 25.8 grains of gold ⁹⁄₁₀ fine, and it is immaterial whether this gold is coined or in bullion form. A dollar's worth of merchandise is as much of it as will exchange for 25.8 grains of gold.

The exchange rate between any merchandise and gold is determined by the same process in the market by which the relative exchange rates between any two commodities, say between bread and clothes, or between copper and lumber, is determined. These ratios depend, in the ultimate analysis, upon the combined influence of utility and difficulty of attainment, the latter including both the factor of labor and of scarcity. Prices are, therefore, independent of the amount of money in circulation, except in the measure in which the use of gold as a money metal enhances the demand for gold. And if an increase of currency is contingent on an increase of the gold reserve, the increased demand upon the gold of the market has the tendency of increasing the purchasing power of the dollar. In other words, the tendency will be toward a lowering of prices, not a rising, as intimated by Dr. Lotka.

His illustration may be varied as follows. Let it be assumed that the amount of money in circulation is $1,000,000, the rapidity of circulation 25 per year, and the yearly product of industry one billion pounds of goods, the price of which is 5 cents per pound. Then it follows that only one half of the goods produced can be marketed and that the other half remains unsold. This is what actually happens during periods of unemployment which, by the above line of reasoning, can be traced to an inadequacy of currency.

The late rise in prices was probably impending since the cyanide process of mining gold was introduced. But through economic inertia the value of gold was for a number of years maintained above its natural rate, and it was the shock of the war that caused a sudden lowering of its purchasing power, possibly even below its natural level. If so, prices will come down somewhat, even though the volume of currency be increased materially.

Our Reserve currency consists of "Promises to Pay Dollars" which, of course, means gold, and it is the gold promised by the issuers that determines the value of these notes. No banker would consider a promissory note received from a responsible business man worth any less just because there are a greater number of valid promissory notes in existence today than there were yesterday. Why, then, should those promissory notes that are accepted as a medium of exchange lose any of their purchasing power if there are more of such notes in circulation today than there were yesterday? The so-called Volume Theory of the value of money is based upon loose reasoning. It is founded on the notion that currency notes owe their purchasing power to the fact that they are permitted to be employed as a medium of exchange, while in reality the promise on their face is that which imparts value to them.

HUGO BILGRAM.

Philadelpnia.

To the Editor of the SCIENTIFIC AMERICAN:

With reference to the letter from Mr. Hugo Bilgram which you have very courteously submitted to my inspection, I have the following remarks to make:

The letter opens with the statement that "an obvious fallacy in the theory of prices is continuously reiterated, namely that the purchasing power of the dollar is determined by the *demand for money* divided by the product of its supply and the velocity of circulation."

If Mr. Bilgram will carefully read over again my article "Our High Prices," he will find that nowhere in this article is any such statement as that quoted above made. In fact, the phrase "demand for money" which Mr. Bilgram introduces into the discussion is one which does not appear anywhere in my article.

The principle on which my article is based is not the one enunciated by Mr. Bilgram, but one which might be stated as follows: the purchasing power of the dollar is determined by the *total sales* (*e.g.*, the number of pounds of goods sold) in the unit of time, divided by the product of the number of dollars in circulation and their velocity of circulation, *i. e.*, the number of times each dollar changes hands, on an average, in the unit of time. (For a detailed discussion of just what must be included in the terms "total number of dollars in circulation" I must refer Mr. Bilgram to Prof. Irving Fisher's book "The Purchasing Power of Money.")

It will, therefore, be seen that Mr. Bilgram begins his letter by setting up a statement which I did not make, and then proceeds to discuss this statement. In a sense therefore, the remainder of his letter is irrelevant so far as my recent article in your columns is concerned. Nevertheless I will briefly deal with some of the other points in Mr. Bilgram's letter.

In the second paragraph of his letter he first restates a certain simple example from my article, and then continues "he (referring to the undersigned) then argues, that if the amount of gold in circulation were doubled, the price of the commodity per pound would be just twice what it was before."

Mr. Bilgram has here omitted a very important clause in the argument. By referring to the last paragraph in the center column on page 12 of my article he will see it expressly stated that, in the case under consideration, while the total currency in circulation is supposed to be doubled, *all other conditions remain unchanged*, and in particular the total sales are still one billion pounds of goods, as before.

Mr. Bilgram's difficulty "to see by what process of reasoning" my conclusion is reached, is due entirely to his omission of the clause mentioned above, which is quite essential to the argument. This disposes of the third paragraph in Mr. Bilgram's letter and also of the fifth paragraph.

In connection with this latter his attention is also particularly drawn to the third paragraph on page 12 of my article, which reads as follows:

"In practice, of course, it will never happen that a change in the amount of currency in circulation takes place unaccompanied by other changes in various economic factors. But the effect of the change in the amount of currency in circulation will be essentially the same, though the influence of other factors (such as an increase or decrease in production of commodities) may be superimposed upon that of the change in circulating medium, so as either to reinforce its effect or to mask it more or less completely."

With regard to the fourth paragraph of Mr. Bilgram's letter I will remark briefly that the quantity theory of money fully takes into account the withdrawal of gold from circulation as currency, for use in the arts or in the jewelry trade. Any such withdrawal will diminish the quantity of money in circulation, but whatever balance it leaves in circulation is the quantity that enters into the discussion, so that allowance for withdrawal is made automatically when the data of the problem are furnished.

With regard to paragraph six, Mr. Bilgram's attention is drawn to the illustration at the bottom of page 12, which shows that the purchasing power of money had diminished in the ratio of 105 to 60 during the years 1896 to 1914, so that it is quite impossible to ascribe all or even nearly all of the rise in prices to the world war.

Those parts of Mr. Bilgram's letter to which, for economy of space, I have not referred specifically, merely show that he has failed to understand the so-called quantity theory of money.

In conclusion I can only recommend to Mr. Bilgram and other readers interested in this very important subject, that they should study with care Prof. Irving Fisher's book mentioned above, in which all these points are set forth in much greater detail and much more completely than can possibly be done here.

I take this opportunity to correct a misprint which occurs on page 13 of my article, where the total amount of gold in circulation in 1896 is given as .88 billion dollars. This should be 8.8 billion dollars.

ALFRED J. LOTKA.

New York.

A Daylight Meteor

To the Editor of the SCIENTIFIC AMERICAN:

On Friday evening, June 13th, 1919, about 7 o'clock, that is to say about 6 o'clock according to the usual standard time, there passed to the southwest of Kensington, Md., a daylight meteor.

The meteor has an apparent diameter of from one-sixth to one-quarter of the diameter of a full moon. It traversed an arc of about 30 degrees in the center of the southeast portion of the compass. The arc was 30 degrees above the horizon at the beginning of the arc, and 15 degrees above the horizon at its end. The meteor went from north to south in the middle third of the S. E. Quadrant. It was extremely brilliant—so brilliant as to attract my attention, even in broad daylight, but there was no sound of an explosion when it disappeared.

Although under the law of coincidences or of occurrences many meteors must have passed during the daylight hours I have never heard before this of their occurrence, and should suppose their observation to be comparatively rare. Numerous other people saw it in this neighborhood and in the vicinity of Washington so that I cannot think of the fact as being an hallucination.

C. G. DICKSON.

Washington, D. C.

Visible Shells

To the Editor of the SCIENTIFIC AMERICAN:

I note in your issue of March 15th, a query (No. 14304), by J. E. R., relative to possibility of seeing and hearing shells in time to dodge same.

It is very often possible to do this latter as most of the shells fired on troops have remaining velocities under 340 meters per second. This applies to all howitzers, and to most guns of ordinary caliber, except at short ranges, as reduced charges are generally used where possible, so that when one is near a dug-out entrance, it is often possible to save one's skin by prompt action. Ask any artilleryman who has been much skilled!

As for seeing, that is different. As everyone knows, it is possible to see the departure of projectiles of moderate size (above 75 mm.), at velocities up to 600 m., when one is directly behind the piece. For velocities under 400 m., it is possible to see the projectile from the side. Standing directly behind a 75 on a clear day, it is possible to see the projectile all the way to the point of fall, using a pair of 8X Germaire binoculars.

The "receiving" end of the trajectory is different, and, naturally, one can't spend his time gawking up into the firmament to see if anything is coming his way.

However, with a pair of 15X "Gong Nue" binoculars ("Scissors"), I once saw several shells from a "1554" battery cross the field of vision, on their way into a valley, while I was observing "75" fire on the opposite slope. The day was very clear, and the distance to the point where the trajectory crossed the field of view was about 800 or 900 meters. But I have never seen an enemy shell in flight, nor seen anyone else who has, from our side of the lines.

ROBERT H. WOMSLEY,

2d Lieut., Field Artillery, A. E. F.

The Hudson Tunnel

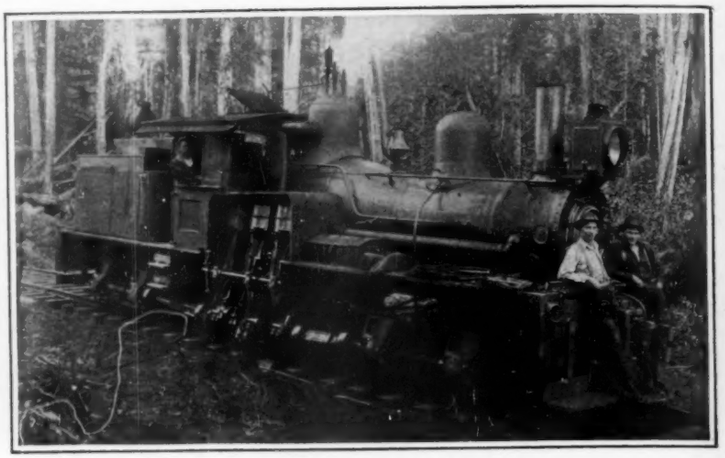
To the Editor of the SCIENTIFIC AMERICAN:

I have just read your article on the proposed Hudson River tunnel for street traffic. I think it can be used as soon as built for all kinds of traffic. Have long low platform electric cars. Let there be loops of track a few hundred feet from the entrance and exit of the tunnel, so that all autos, trucks, etc., can load and unload in the open air or under open sheds. Have all gas engines stopped and oil lights put out as is now done on the ferries. Platforms to be built even with car floors as in subways. Runways partitioned off on the cars to prevent side crowding. The cars can be wide enough to take on any auto or dray lengthways so that, say ten or twenty autos or trucks could drive on at once. This would save a lot of time in loading and unloading. Have a switch or two at one side for lengthwise loading for use of extra long trucks or trucks with trailers as is now done on ferries. In other words, use the tunnel as an underground ferry with electric ferry cars.

H. L. GERLAND.

No. Cambridge, Mass.

Airplane spruce being prepared for movement to the mill



A typical logging engine in the Northwest

Burning the Profits

A Problem Confronting the Lumber Industry of the Pacific Coast

By Thomas W. Bibb

WHEN one steps off the train at a certain lumber manufacturing town on the Pacific Coast, his attention is called to a mammoth upright cylinder of concrete from which the smoke issues in black clouds. Should he be unacquainted with sawmill methods, he will find himself uncertain as to the function of the giant tower. Inquiry will reveal that the big cylinder is a furnace into which are dumped hundreds of cords of discarded wood, every single day, in the form of slabs and sawdust, to be destroyed by fire—the most proficient method that has been discovered for getting rid of the offending portions.

The stranger is astonished at the magnitude of the device, and at the amount of material which goes up in smoke in this manner; his good sense rebels at the sight. Is this wood not good for something? Is it not possible to make boxes, or chemicals, or some other useful commodity from it? Can it not be sold for fuel?

These are pertinent questions. They are questions which to date no one has been able to answer satisfactorily. They represent one of the big problems confronting the lumber interests of the Pacific.

The meat-packers were the pioneers in utilization of discarded material. They made a religious effort to find a use for every gram of animal tissue that came into their works. If there was anything about a cow or a hog that was of no value on the market, these alert butchers sent the fragment to the laboratory; and when this same fragment had passed the chemist's scrutiny, it came forth transformed into a camel's hairbrush, a butter substitue, a handsome birthday candle—but always something serving the more important function of bringing additional dollars.

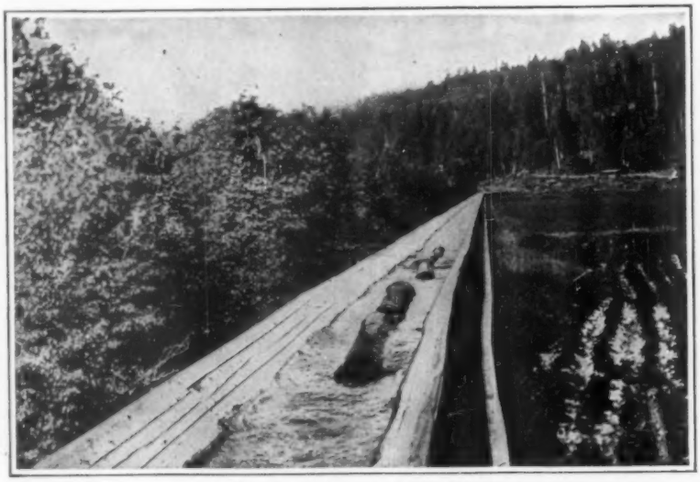
A similar wave of effective production has swept through most of our important industries. The railroads now call into the shop every ounce of old metal found about the right of way; they restore to service every scrap of paper, everything else that has served its first purpose. This revolution in methods came just in time to save a number of the carriers from bankruptcy, and the statement applies equally to many other industries into which the light of economy has penetrated. No longer is it considered a sign of prosperity for the manufacturer to have his back yard piled high with old metal or decayed bones. If his present methods are such that it does not pay to utilize these wastes, he must find a way to make it pay.

Enormous Waste in Cutting Logs

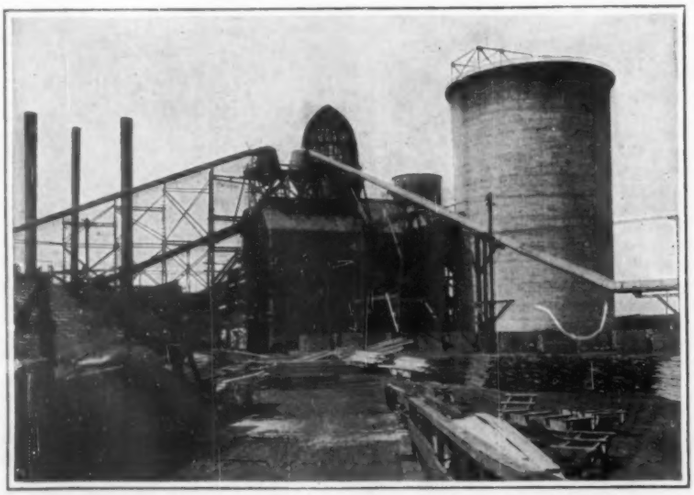
It will be a happy day in the annals of the lumber industry when some profitable mode is found of disposing of the rejected scraps turned out in quantities at every mill. Beginning with the standing timber and ending with the dressed and finished product, the lumberman sees thousands of feet dwindle into nothingness, until the portion that leaves his wharf represents little more than half the trees.

The other fraction is variously distributed. In order to meet the high standard of quality for which the commodity of the Northwest is noted, lumbering has become a process of selection—or, looking at it in the negative sense, a process of elimination. Everybody connected with the lumber business eliminates—the timber cruiser, the logger, the mill man, the yard man, the carpenter. Each in his turn has a certain amount of unprofitable material which he must get rid of in some way.

Wherever there is a logging camp the waste begins. It is necessary to cut many trees high up, often on account of heavy resinous substances, more often on account of the shape of the base. Thousands of feet of wood are thus left standing, and a great deal more is left on the ground to decay. This leaves a sea of stumps ranging in size from three to ten feet in diameter, and about as tall as they are broad. About the only good that has been derived from these is their occasional use as supports for clothes lines or as anchors for donkey engines. We might add an apology to the candidates for office and the venders of tobacco and drugs, who have used those skirting the highways as media for display.



A logging flume in eastern Washington



The concrete burner with its iron predecessor in the background

It will never be possible to convert 100 per cent of a log into planks, any more than it is feasible to fill a round hole with a square peg. Bark and sawdust, ends and irregular pieces in general have no market value and must be thrown aside. Now in the case of the logger, elimination is a very simple process. He takes what he wants, and leaves the rest on the ground; there is no trouble or expense. Not so with the miller. After he has cut his log, got the marketable portion aboard the steamer, he is faced with the annoying problem of eliminating the unmerchantable refuse. Unlike the packer, he has not reached the stage where he can sit serenely back and look for a handsome income from a score of by-products. True, this waste is good clean dust and slabs. Yet, excepting the small part which is sold for fuel, there is no market for it; no method of profitably utilizing it for the manufacture of naval stores, or other chemicals, has been discovered.

It would be considered a stroke of rare fortune to be allowed to dump the debris into the river where it might be washed to sea, and there, perhaps, flavor the food of myriads of fishes. But the government determined years ago that underwater life does not thrive on sawdust, and put a stop to the practice once in vogue.

This led to that remarkable invention the burner—a giant upright cylinder of iron about thirty feet in diameter by 100 feet in height, with a semi-globular framework on top made of the same material, and covered over with a wire screen to arrest the sparks. An endless chain conveys the refuse up a chute into the receptacle. It is lined with fire-brick—the

necessity of the precaution being readily seen at a glance into the flaming interior.

This invention works beautifully until the endless chain begins to feed the debris too rapidly. Then it gets overheated and sparks begin to fly. Under those circumstances, it is a noticeable fact that fragments of logs are not the only things about the apparatus that are consumed, for the bricks themselves give way, while the rich acids seem to have a peculiar appetite for the screening on the dome, and it, too, succumbs. Such is the result of overfeeding.

The Costly Disposition of Waste

There is a large plant on Grays Harbor, that has had its share of trouble of this sort. This mill has an average daily output of 600,000 feet of the finished product, a quantity sufficient to fill to capacity a train of 25 cars. The refuse attending such a large cutting is enormous.

It was beyond the power of the burner of this plant to digest the material properly. The netting was burned off every few weeks; replacing it was costly. Not only did the repairs have to be paid for, which itself was no small item, but there was the more serious matter of shutting the factory down while they were being made. The loss from all this was some $5,000 per year.

But the managers were swamped with orders. They saw even bigger business in the future; in fact, they believed they could sell a million feet a day, but what was the use of putting in additional machinery and hiring more men in the face of such an obstacle? So they decided to eliminate this tiny burner, which was only 25 feet in diameter, and replace it with a massive consumer far superior in capacity to anything to be seen on the Pacific Coast.

This is the last word in furnaces. From a distance it resembles an ancient fortress. It overtops the highest flues of the mill, and its diameter is so large in comparison that they resemble mere pipe stems. Imagine a square mile of tide flat, covered with piles of lumber, and in the midst of the lumber a number of buildings crowned with smoke stacks. Among these is a concrete cylinder 64 feet in diameter, and 106 feet in height, with a few small openings, resembling portholes, toward the bottom, and a steel frame on top, not unlike the bridge of a battleship.

Building burners of cement is an experiment. To prevent the overheating of the concrete, a space is left between that wall and the brick lining. In order to get a substantial foundation, it was necessary to drive into the tide flat 420 pilings, each 45 feet in length. This particular burner represents an investment of close to $25,000. It is not yet possible to estimate its capacity for eliminating waste, but at this time it is getting rid of 150 cords per day. Not only does it have an appetite for chunks and sawdust, but it eats up the interest on that $25,000 quite as easily.

Thus we see the lumber manufacturer has not been able to reap a profit from by-products, while makers of other commodities have added substantially to their incomes in this respect. Some plants have furnished electric power to municipalities, while in other cases boxes have been made out of the discard, but in either event the demand is small in comparison to the amount of unmerchantable material accumulated. If you bear in mind that in one section there are ten big mills turning out this accumulation within a radius of five miles, you can see the effect of a scarcity of markets for power and containers.

You may ask if no attempts have been made to manufacture turpentine and oils out of this stuff. Various experiments have been carried on by the government, and certain universities, which have made very favorable reports upon the practicability of using Washington fir and spruce for this purpose, with the net result that several factories for the distillation of wood waste have been put into operation, but the industry has not survived the experimental stage. Two incidents may be related to indicate why.

One manager who hated waste in any form set up an experimental distillation apparatus in the yard, according to the designs of a self-styled chemist from the east. The way this expert went about his work pleased the mill people mightily. He did not ask for a big capital to start on; all he wanted was a shed and an old boiler with the tubes removed and enough bricks to build a furnace around it. Barrels of wonderful distillate were obtained; the best tar that ever went into a shipchandlery came out of that retort. But the expert didn't know how to separate the volatile oils from the condensed raw liquor. He was saved the pain of confession when he allowed the retort delivery to become clogged; gas accumulated in it, and the ancient hulk found relief with a noise like a naval engagement. Incidentally, the plant was relived of a by-products plant and a near-chemist, who made his departure on the first train.

The opposite extreme may be just as unsatisfactory. A man may know too much chemistry, and too little of business necessities. A group of manufacturers considered erecting a factory at Puget Sound to take care of the stumpage and mill waste from a large area. They got the very best chemical engineer available, who came all the way from Europe with a trunk full of blueprints and formulas that had been tried out and put in use in the old country. This noted gentleman looked over the field and made every conceivable test; then he rendered his report. The wood was rich in volatile oils of the highest quality; location was suitable and markets were right. It was feasible to construct a paying plant; he recommended that they begin at once; he would superintend the work. It would be planned after the most modern European plants, and they need not worry about a single detail, except the raising of the funds—$400,000.

Four hundred thousand dollars for a junk plant! When the promoters had recovered their breath they wished the engineer a very pleasant trip back to Europe. So was another promising project nipped in the bud.

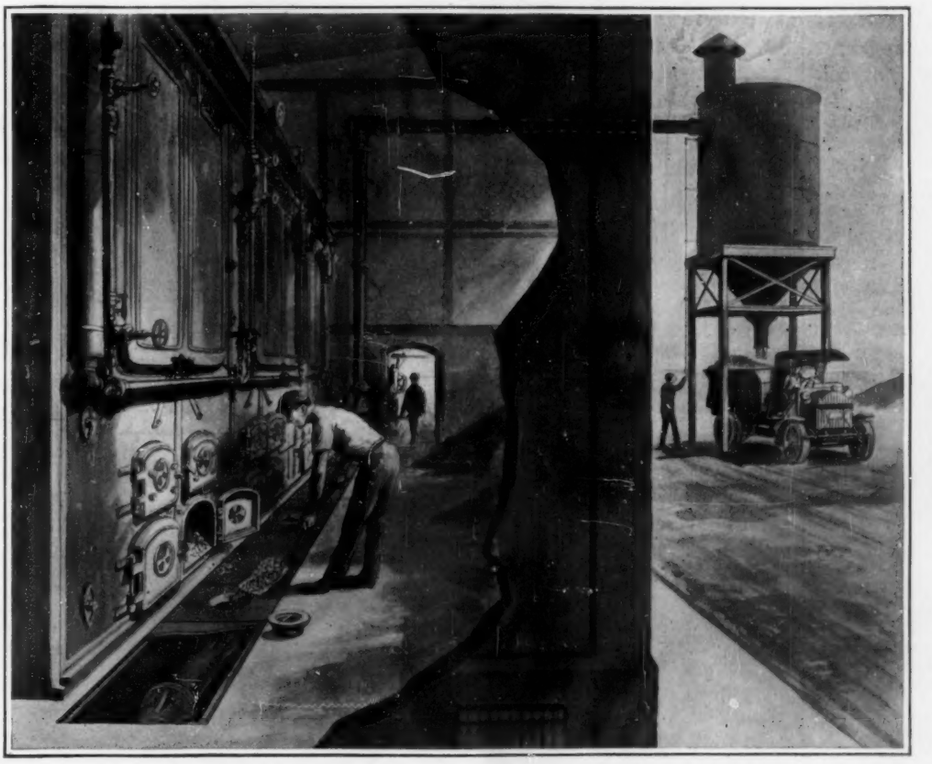
In still other cases of failure the cause might be traced directly to the lack of technical control, although in many instances it is due to bad market conditions. For instance, a turpentine factory started up on Puget Sound, and apparently was doing well. They were getting their oil by the destructive distillation method, and in their small way demonstrated to the satisfaction of visitors that they were making money. Finally, a small group of capitalists were interested, and, taking along a chemical engineer, went to look at the plant. The capitalists saw nothing wrong, but the engineer found a serious defect. The apparatus was being eaten up by the rich acids. It was not adapted to the use to which it was being put—in a very few years it would have to be replaced. A very poor investment! No one except a technical man would have discovered it.

Heretofore there has not been a brisk demand for wood products in this country. There are many and various oils and plastics which may be made out of the refuse, but in most cases it has been necessary for the manufacturer to employ a large sales force to get rid of his goods. He could not afford to do this. The products are not standardized, and not a few of them have no commercial value, because their use has not been discovered. There is a large field for research along this line. It is possible that many new manufacturing methods will arise, which will use these cellulose commodities as a crude material.

Thus, we read with alarm of the shortage of crude materials for the manufacture of paper, and at the same time we view with apprehension this loss of valuable pulpwood. However, there are large factories of this nature being erected in Washington, some of which will utilize the refuse of the mills. It is a step in the right direction.

If our laundry is returned in a state of unsatisfactory whiteness, we think of the tons of discarded sawdust—the chief constituent of oxalic acid, universally used as a bleacher—and of how the laundryman has been dependent upon imports from Germany to get this commodity.

In a daily paper we read of a probable shortage of gasoline at some future date, and in the same issue we see a new plan to substitue denatured alcohol, made from wood refuse, for the purpose of running automobiles. Under the stress of necessity for these, and other articles, we may feel assured that the wood by-products business will come into its own.



Dust-free boiler room in which the ashes are removed by means of a steam jet

Disposing of Ashes with Steam

THE problem of disposing of ashes in most large power plants is considered almost as great as that of supplying the furnaces with coal. To be sure there is not so much ash as fuel but it is a disagreeable, dusty material to handle and being a waste product the expense of removing it figures up as a loss. The time-honored method of removing ashes is to wheel it out of the boiler room and dump it in a pile somewhere near the plant whence later the ashes are shoveled into wagons and carted away. The modern method, however, does away with all this bother, cutting down expense and doing away entirely with the dust and dirt. The ashes are conveyed out of the boiler room to an ash bin which is elevated so that ash carts or motor trucks can run under the bin and receive their load of ashes from a chute by gravity.

An ingenious method of conveying the ashes to the bin is now being employed, which involves no moving parts except a current of air and a jet of steam. There is a pit in the floor of the boiler room in front of the furnace doors in which is located a pipe. This is provided with openings at suitable intervals which are closed by airtight covers. At one end of the pipe, preferably where it turns vertically to take the ashes to the bin, a steam jet is located. This when operated produces suction in the pipe in the boiler room so that when a cover is removed the air rushes into the pipe and as the ashes are dumped into the opening they are carried by this current of air to the steam jet. Here the steam itself forces them on up the vertical portion of the pipe and thence into the bin. The latter may be located at any convenient point outside of the plant. The pipe line is made of sections provided with broad flanges that are bolted together and sealed with asbestoes cement, making airtight joints.

As may be expected the wear of the ashes is considerable and for this reason liners are provided for the lower

(Continued on page 119)

Our Technical Achievements in the Great War—I

Making Four Million Soldiers of Four Million Citizens

TO gather the accurate statistics of such a great war as that which has recently been fought is a task requiring much time and very great care. Such statistics have recently been completed, at the request of the Secretary of War, by Colonel Leonard P. Ayers, Chief of the Statistics Branch of the General Staff, and we propose, in a series of chapters of which this is the first, to give a digest of these statistics. They form the first authentic statement, of this comprehensive character, which any of the powers engaged in the war has set forth, showing in detail the character of the military effort.

Four Million Citizen-Soldiers

About 4,000,000 men served in the Army of the United States during the war from April 6th, 1917, to November 11th, 1918. The total number of men in the armed forces of the country, that is to say in the Army, the Navy, the Marine Corps and other services was 4,800,000. Hence among every 100 American citizens approximately five took up arms for their country.

In the Civil War 2,400,000 men served in the Northern army and Navy, and we believe over 4,000,000 were enlisted in the struggle on both sides. In that war 10 in each 100 inhabitants of the Northern States served on land or sea. Comparing our numbers in this war with those of the Northern States in the Civil War we raised twice as many men in numbers, but in proportion to the population we raised only half as much.

It is difficult to compare the numbers in the American Army during the present war and those of our Allies or associates, because of the diverse military policies. France, for example, put into uniform most of her able-bodied men who were not beyond middle age. Some were sent into the combatant forces and some into the service of supply of the active armies; others were sent to munition factories; others, again, worked on the railroads or cultivated the farms. In other words the French Government first put its available man power into uniform and then assigned its soldiers to the work, whether it were of a military nature or not.

Our policy was to take into the Army only those physically fit to fight and assign them to the ordinary duties of a soldier. The work of making munitions; running railroads; building ships; and so forth, was done by men not enrolled in the armed forces.

Our Army at Home and in France

When we entered the war it was not anticipated in America, nor was it suggested by France and England, that the forces to be shipped overseas during 1918 should even approximate the vast numbers that were actually sent. What makes our effort so commendable was the concentration of the greater part of our effort into the few months of the Spring and Summer of 1918. By reference to the accompanying diagram, showing the thousands of soldiers in the American Army on the first of each month and their distribution, and the proportion of them which were at home and abroad, an accurate impression is gained of just what we did in the way of providing armies and putting them across in 1917 and 1918.

It was only when the German drive was made in March of last year that we made that supreme effort in response to the call of the Allies, which enabled us, with the assistance of the British merchant fleet, to put a million and a half men in France in the brief period of six months.

When war was declared there were only 200,000 men in the Army, of which two-thirds were Regulars and one-third National Guardsmen. By the end of the war this force had increased to 20 times its original size. Immediately after the signing of the armistice demobilization of the troops began. As the diagram shows, over 600,000 were discharged in December. The forces in the United States were cut down to the lowest point consistent with the storage of our vast equipment and the settlement of contracts. It is interesting to note that demobilization was carried on more rapidly in proportion to the number in arms than in any previous American war.

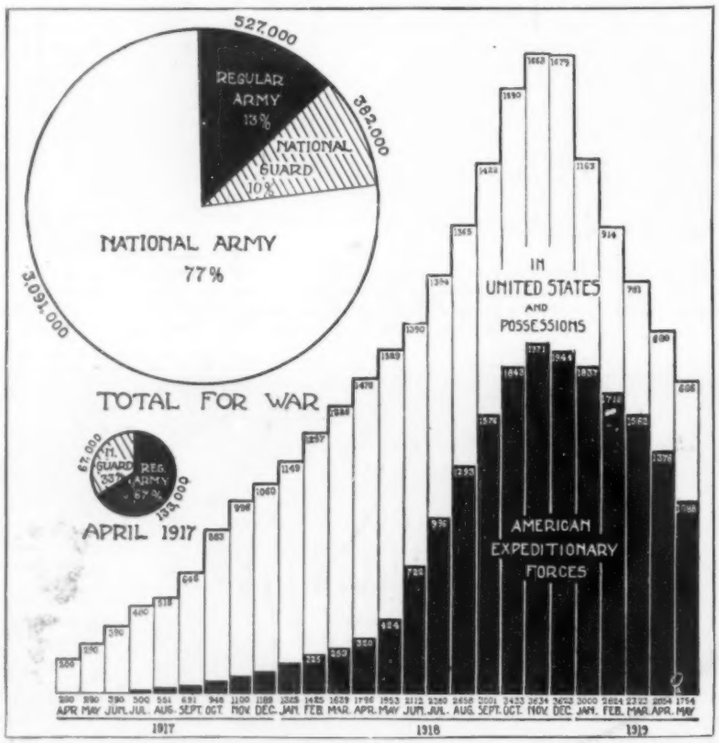
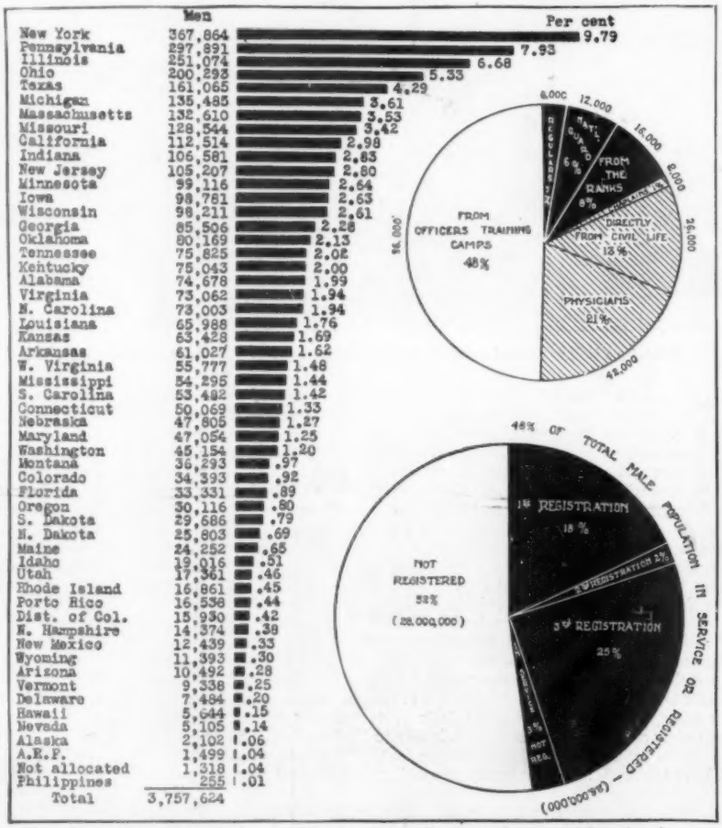

527,000
REGULAR ARMY 13%
382,000
NATIONAL GUARD 10%
NATIONAL ARMY 77%
3,091,000
TOTAL FOR WAR
67,000
NAT'L GUARD 33%
REG. ARMY 67%
133,000
APRIL 1917
IN UNITED STATES AND POSSESSIONS
AMERICAN EXPEDITIONARY FORCES
330 330 390 500 551 691 948 1100 1389 1825 1425 1639 1796 1953 2112 2260 2656 2501 3423 3634 3693 3000 2694 2732 2654 1754
APR MAY JUN. JUL. AUG. SEPT. OCT. NOV DEC. JAN. FEB. MAR. APR. MAY JUN. JUL. AUG. SEPT. OCT. NOV DEC JAN. FEB. MAR. APR. MAY
1917 1918 1919

Diagram shows, in thousands, number of soldiers at home and abroad on the first of each month. The circles show distribution of men in peace and in war



The above shows, by relative lengths of horizontal bars, the number of soldiers furnished by each state

Upper circle—Sources from which commissioned personnel came. Lower circle—Shows the male population of United States, registered and not registered

The Selective Service

Nothing in the history of the war was so surprising and gratifying as the patriotic willingness with which the people of this country accepted the universal draft. How enthusiastic was the support given by the country to the war program is shown by the fact that, in spite of previous hostility to universal service, the drafted soldier was given as honorable a position in the minds of the American people as the man who had enlisted voluntarily. It is gratifying to know that desertion from the Army was smaller than in previous wars, and that a smaller percentage occurred among the drafted men than among those who volunteered.

Under the Selective Service Law of May 19th, 1917, and under its subsequent amendment, all the man power of the nation from the ages of 18 to 45 inclusive was mobilized. Under this act 24,234,021 men were registered and slightly more than 2,800,000 were inducted into the military service. The first registration June 5th, 1917, covered the ages from 21 to 31; and the second registration, one year later, included those who had become 21 years old since the first registration. Under these two registrations 10,679,814 were registered and 2,666,867 were inducted into the Army. The third registration including men from 18 to 20 and 32 to 45, included 13,228,762 men of whom 120,157 were inducted. Alaska, Hawaii and Porto Rico yielded a registration between the ages of 18 and 45 of 325,445, of whom 23,272 were inducted into the Army.

Out a total male population at the outbreak of the war of about 54,000,000, some 26,000,000 were either registered under the Selective Service Act or were serving in the Army or Navy without being registered.

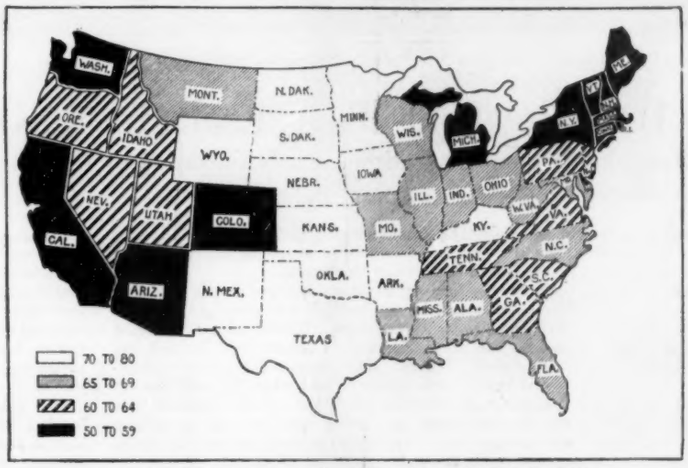
Rejections of Men for Physical Reasons

A study was made by the War Department of the records of the two sets of physical examinations, with a view to showing how the men from the different States compared in their physical qualifications. The results are shown on the accompanying map. The highest physical qualifications were found in the Middle West, where from 70 to 80 per cent of the drafted men were accepted. Next come the States in which 65 to 69 per cent were accepted, and these lie generally to the east of the Mississippi River. The third group, in which from 60 to 64 per cent of the young men were accepted is indicated by heavy diagonal bar shading. The poorest quality of young manhood with an acceptance of only from 50 to 59 per cent was found in the Northeast and the Far West. The low ratio in the Far West is accounted for by the fact that those States which are shown in black have become popular as health resorts and have attracted many physically subnormal people. Speaking generally, it is noteworthy that the best records were made by those States which are agricultural rather than industrial, and where the number of recently arrived immigrants is not large. Conversely States with low

records are manufacturing States with large numbers of recently arrived immigrants.

Providing 200,000 Officers

The Army of 4,000,000 required 200,000 trained officers. Of this number less than 9,000 were in the Federal service at the beginning of the war. The sources from which the commissioned personnel was obtained is shown in the accompanying diagram, the figures of which reveal that of every six officers, one had had previous military training in the Regular Army, the National Guard or the ranks; three received their training for commissions in the Officer's Training Camps; and the other two went from civilian life into the Army with little or no military training. In this last group the majority were physicians, a few were ministers, and most of the rest were men of special business or technical equipment.



Per cent of drafted men passing physical examination, by States

New Chisel Steel of Unusual Properties

AN American steel company, making all grades of electric tool steels, announces that it has produced an alloy chisel steel which can be made so hard that it will cut glass yet may be bent by being hammered over the edge of an anvil. This steel, the manufacturer states, has a wide temperature range, as it may be heated anywhere between 1,650 and 1,950 degrees F., and yet give good results.

The steel seems to have its greatest value when heated to 1,750 to 1,800 degrees, quenched in oil and slightly drawn. The drawing, it is stated, does not seem to affect the hardness of the steel, but it helps the toughness. Many theories can be evolved as to just why this slight drawing is of such assistance to this steel, but metallographically there is no evidence of difference between straight hardening and hardening and drawing. The same structure can be produced as seen under the microscope, yet there is a great deal of difference between the two heat treatments.

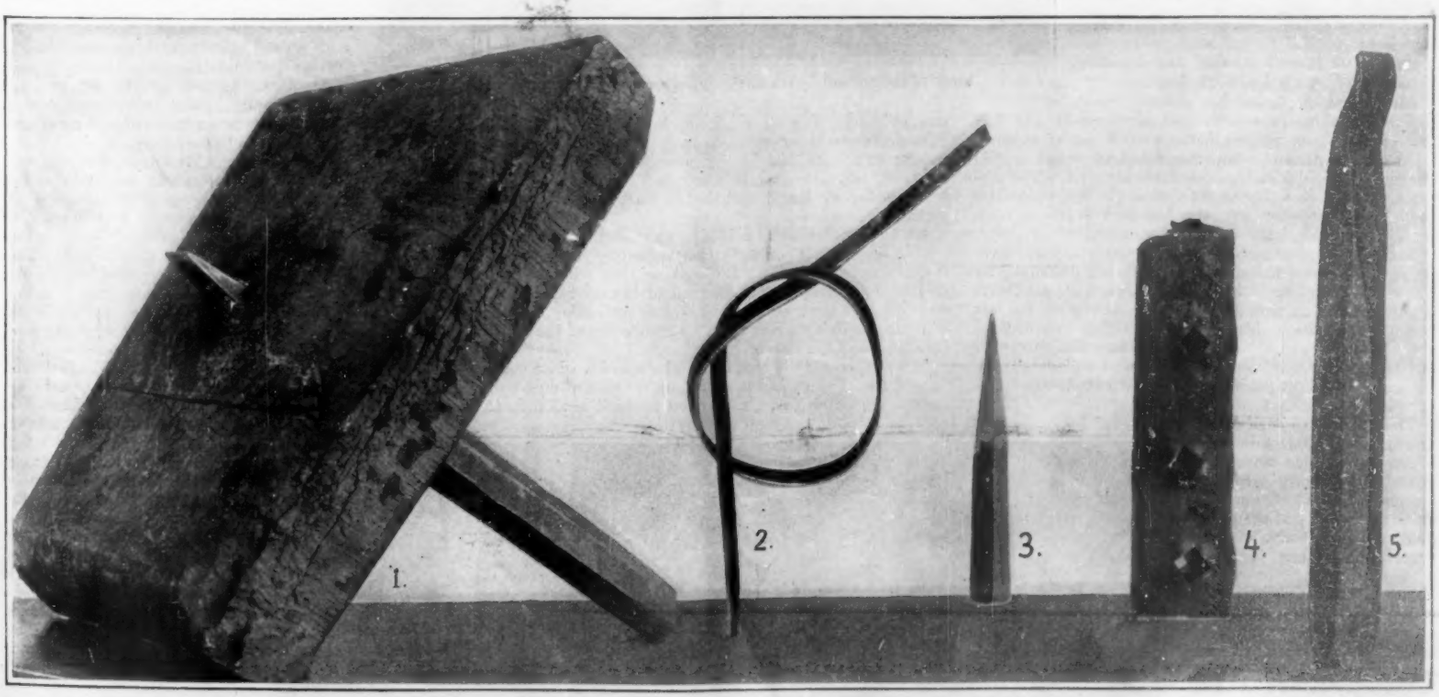
A point emphasized is that the head of a chisel made of the new steel will not sliver. It is also stated that the head of the chisel can be heat treated so that it may be filed, yet it will not break out or crack. It will spread, but it will not split, yet the top of the head does not take on a very glassy surface and seems to have a grip on the hammer-face when it is struck.

It is pointed out that metallographically the steel is peculiar. It seems to have a very fine structure, which is difficult to define. It may be a solid solution which is generally regarded as austenite, or it may be martensite. It seems under the microscope to have an appearance at lower magnification of the whole range of solid solution steel, yet it has the characteristics of none. Under high magnification of 1,200 diameters the structure appears to be somewhat like martensite, yet the martensite appears to be lamellar rather than the usual 60 degrees marking.

The grain boundaries, which are particularly tenacious, have the coloring effect of troostite, yet they do not have the usual troostite formation. Troostite does not begin to form in round spots at the grain boundaries in Seminole steel, but seems to have the characteristic of broadening out the grain boundary into a dark line. From this stage the entire grain begins to etch a little more rapidly and take on a darker color, but the ground mass of the grain does not appear to alter in general characteristics as is usually found in the transformation from austenite, martensite, troostite and sorbite, as understood as applying to the usual form of alloy steels or carbon steels.

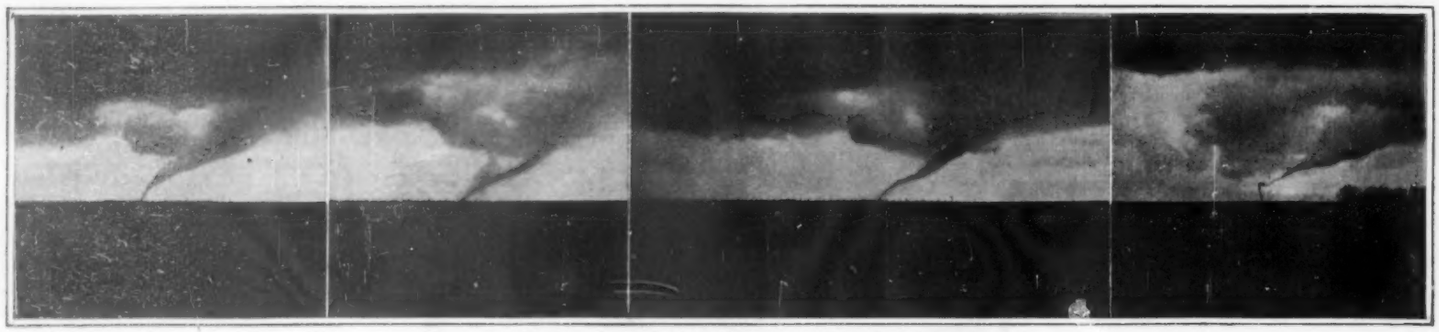
The Current Supplement

THE recent visit to our shores of the great British zeppelin "R-34" and her successful return trip to England was the conclusion of a triplet of successes in the aerial world. Not least among these was the successful long-distance endurance flights of our own navy's flying boat "NC-4" and the story of the development and perfecting of this craft will always be of great interest to us. The story is told by the engineer in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2274, for *August 2, 1919*, under the caption *Progress in Naval Air Craft*. One of the special problems connected with warplane construction is the choice of a wood that will stand up well under rifle fire and not splinter so badly as to seriously wound the occupants of the plane, or to weaken the struts of the wings. In the illustrated paper, *Splintering of Airplane Woods* we learn the results of numerous appropriate tests made for this purpose by the U. S. Forest Products Laboratory. A detailed account of methods and appliances and theory of *Photography in Research* illustrates how microscope, camera and cinematograph may be and are applied to further the study of internal structural conditions of stones and metals, at rest and under strain. The corrosion of brass is discussed in a long article on the *Life of Brass Condenser Tubes*, and some practical suggestions as to the protection of the tubes by preliminary treatment. Man in England and the British Isles has a very ancient history, and some recently discovered prehistoric remains at Piltdown have caused considerable discussion. The present article on *Pre-Paleolithic Man in England* will be found a very convenient review of the evidence for and against such antiquity as the title of the paper implies. To carry the story back far beyond mere Pre-Paleolithic times we have included a shorter discussion headed *When Did Our Ancestors Take to Trees?* in which the author points out cogent reasons for believing that the divergence of the first digit in the primitive mammalia foot was an inheritance from primitive terrestrial reptilian conditions and not from arboreal ancestors. The article on *Flotation for the Practical Mill Man* is concluded. The question *What Is a Chemical Element?* is examined by the help of a systematic table of the radio-active elements showing their interrelations. Among the shorter articles: *One Year of Air Mail Service* in the United States brings out the practicability, reliability and even economy of the airplane as a mail carrier; *Sub-Antarctic Whaling* directs attention to discovery and relative increase in value of the Antarctic whaling grounds; and the *Railways of Japan* records the increased mileage and rapidly improving transportation facilities of that country. Chain and screw couplers are being replaced by automatic center draw-bars.



A demonstration of some of the peculiar properties of the new chisel steel

1. Chisel of the new steel driven through a piece of wrought iron over an inch thick. 2. The steel can be bent without breaking or cracking. 3 and 4. A punch and a piece of steel through which it has been driven. 5. Tools of this steel can be formed into unusual shapes.



Successive stages of a tornado, in Nebraska, that tied itself in a knot

A Tornado That Tied Itself in a Knot

A Remarkable Loop Formation Luckily Recorded by the Camera

By H. T. Dobbins

STARTLING pictures of a tornado in action were secured by two lucky photographers who happened to be in the vicinity of Elmwood, Neb., when one swept through a seven-mile stretch of territory on the evening of April 6th. Two of these, the last in the series here reproduced, are characterized by Section Director Loveland of the Nebraska Weather Bureau, a veteran observer of tornadoes and their phenomena, as easily the most remarkable that have ever been taken.

The pictures are unusual, not only in that they are close-ups of the whirling funnel, but in that they disclose the formation of a loop or knot that worked its way from the bottom almost to the top, where it disappeared in a [illegible] effort to twist itself still tighter. The photographs shown here with were taken by W. A. Wood. Another set of photographs similar to these was taken by W. A. Rockie and L. Woifanger, members of the state survey commission, with a moving picture camera they were carrying in their automobile. As the storm passed due east of their point of observation they started north on a parallel course. The storm was traveling at 42 miles an hour, and while one man drove, the other kept his picture-making machine in operation. They raced with the tornado for over two miles, being very close to it when the cloud lifted and the storm dissolved in midair. Being trained scientists they made observations as to its velocity, made notes of the rapidly changing characteristics of the funnel and afterwards retraced the ground covered and investigated what damage had been done.

Mr. Wood, in taking his pictures, was to the east of the storm instead of the west and had the advantage in getting a more vivid set of pictures from the fact that the camera pointed westward toward the sun and had a lighter cloud background. The pictures were taken in the order shown, the first soon after the storm developed and the last just a few seconds before the force of the tornado was spent.

Mr. Loveland says that we have here a very vivid picture of a perfectly good tornado being destroyed by the storm of which it is a part. Upper wind curents were evidently cutting the tornado in two when the last picture was taken. Mr. Rockie says that two distinct kinks were shown in that part of the funnel in the upper air. The picture shows one of them in full detail and the other either in process of formation or in the disentangling stage.

The tornado itself was unusual in that it failed to follow most of the rules laid down for properly-governed storms of that character. In the first place it occurred 300 miles northeast of the center of the low pressure area existing at the time. Usually sultry weather precedes one. In this case the day had been clear and cool, and while warmer in the afternoon at no time was it oppressively so. Rains east of Elmwood had fallen an hour before, and this storm had proceeded southeast, leaving a greatly cooled atmosphere. The usual relative positions of tornado and general storm are tornado to south or southeast and storm center to north or northwest.

When the tornado was first observed it was traveling like a kite's tail, but within half a minute had fallen to the ground. Only ordinary thunder clouds, lacking entirely the typical greenish yellow hue, formed the background. Instead of traveling northeast as customary, it headed directly north, and when it went out of business was traveling northwest. It is believed that the storms prevailing farther east had set in motion strong upper air currents that pressed against this storm and forced it out of the usual direction.

The path of the tornado as marked on the ground, varied from 150 to 300 feet. Outside of this path there was evidence of a strong wind, but it did very little damage, save to crush as though with a tremendous weight an automobile hastily abandoned by its occupant and left standing in the road. The path was seven miles in length and the distance was covered in 10 minutes.

As nearly as could be judged the column was 1,500 feet in height. When the storm veered to the west the funnel began to lean to the east so that when it was dissolved it was leaning at an angle of 45 degrees, caused, as stated, by the rain and hail storms prevailing in that direction. This veering from its course saved the town of Elmwood from destruction.

The funnel was very slender and showed a white core. When it hit the ground it stirred up a cloud of dust and this, with the debris, was carried as high as 300 feet. The observers noted one building that was carried intact to the very top of the dust cloud and there dissolved like a house of cards. The knots did not appear until the storm had traversed half of the distance covered. The first knot was formed apparently at the base, and gradually traveled upward, and was at the top when the dissolution came. This caused an instant disintegration of the entire column, but the dust cloud kept on for over 1,000 yards.

The velocity of the wind where the observers were located did not exceed 10 miles an hour. There were no squalls accompanying the tornado nor was there any of the usual thunder and lightning.

While unusual, such forms of the tornado's stem have been recorded on a number of occasions.

View of the tornado with one loop formed and another forming

General view of the moon at first quarter and at full, and an enlarged photograph showing many crater areas

The Craters of the Moon

By Frederick Slocum

TO the naked eye the moon presents light and dark shadings, whose outlines are sufficiently indistinct to be formed by a person gifted with a good imagination into the "Man in the Moon," the "Girl with Curls," the "Lady Holding a Book," the "Donkey," the "Rabbit," or the "Crab," but with a telescope of even a low power these vague markings are resolved into remarkably distinct topographic features; broad level or rolling plains, mountain ranges and isolated peaks, narrow winding dark cracks, broad bright radiating streaks, and those almost innumerable circular formations, which, from their general resemblance to the effects of terrestrial volcanic action, have been called craters. These features are all well shown in our cuts, from photographs taken at the Yerkes Observatory.

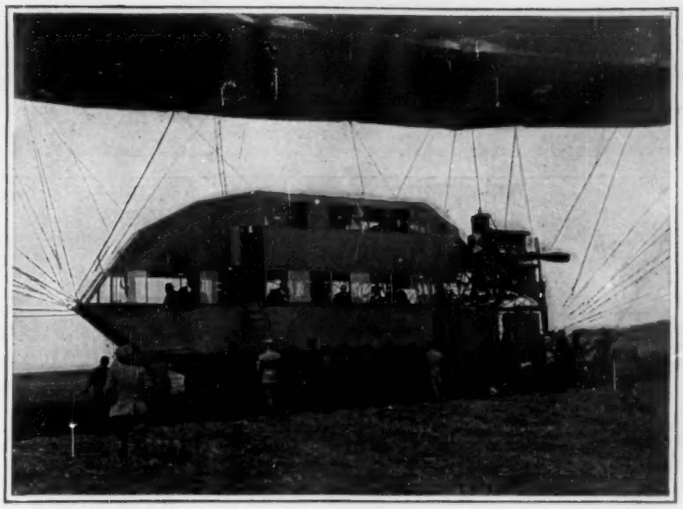
For many years the surface of the moon was supposed to resemble that of the earth, both in its details and in the origin of its various topographic features. Each dark area was called a sea, or *mare*, and we still speak of the *Mare Tranquilitatis*, *Mare Imbrium*, *Oceanus Procellarum*, etc., although it is now known that these regions are not covered with water. The bright areas were supposed to be continents, and the mountain ranges, from their fancied resemblance to terrestrial mountains, were given such names as Alps, Apennines, and Caucasus.

The chief difficulty in interpreting the face of the moon lies in the craters. On the earth volcanic craters are not very numerous and only a few are more than five miles in diameter, while on the moon the craters are numbered by the thousands, and they range from the smallest speck visible in the most powerful telescope to the great circular formations one hundred or more miles in diameter. There is a general resemblance between the largest and the smallest craters, as seen with a small telescope, but, upon examination with more powerful instruments, they present slightly different features, which have led to their being separated into a number of

(Continued on page 119)

A Double-Deck Passenger Carrying Dirigible

NOT only airplanes but dirigibles as well are now being converted from military machines to passenger- and cargo-carrying machines. An example of a converted dirigible is presented in the accompanying illustration, which shows the Italian dirigible M-1 which is now being used for passenger service in Rome. The novel feature of this dirigible is its double-deck gondola. The mounting of the engines, of which there are three, is also a novel feature. Two engines are mounted on each side and somewhat higher than the third engine, which is slightly to the rear. The gasoline tanks are placed below the engines.



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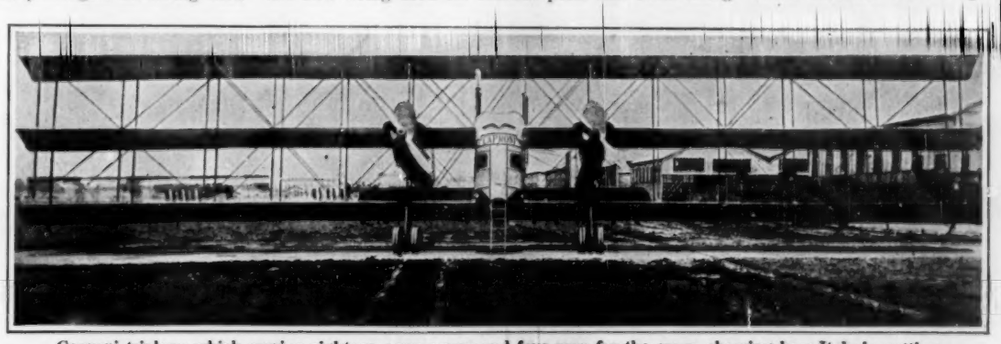
The Italian dirigible M-1, which is now being employed for passenger service at Rome

From Caproni Bombers to Passenger-Carrying Capronis

OF the various large machines employed during the war for long-distance bombing, the Caproni biplane and triplane types appear the most adaptable to civilian flying. Indeed, the Caproni biplanes and triplanes are already beginning to appear in their peace dress, which means with a suitable closed-in body and seating accommodations for the passengers and pilots.

The accompanying views show a converted Caproni triplane which is reported to be fitted with seating accommodations for 18 passengers, inside the cabin, and four above in a special compartment which forms the roof of said cabin. The machine is equipped with three engines, two of which drive tractor screws and one a propeller, making something like 1,200 horse-power in all. The seats in the cabin are arranged along the sides, so that the passengers sit facing each other. The windows are of non-breakable glass. Electric lights and other conveniences are included.

A Caproni biplane recently flew from Villacoublay, France, to the Kenley Airdrome, near London, with a number of passengers. This biplane has been remodeled for passenger service and its closed-in body accommodates eight passengers, while three seats are provided outside for the pilots. The machine carries three engines, which generate some 809 horse-power.



Caproni triplane which carries eighteen passengers and four men for the crew, showing how Italy is putting her bombing machines on a peace basis

The largest Caproni, however, is a triplane with a passenger-carrying capacity of 30. It has a total wing spread of 96 feet 10 inches, and an overall length of 49 feet 2 inches. It measures 24 feet 6 inches in height. The weight, fully loaded, is about 25,000 pounds; empty, the weight is about 14,000.

The motive power consists of five Isotta Fraschini six-cylinder engines of 260 horse-power each. Two engines drive tractor screws while the other three drive propellers. The speed of the triplane is about 105 miles an hour. Most interesting of all, however, is the fact that this triplane has a double-decked cabin for accommodating the passengers. The passengers are seated side-by-side on the upper deck, while the lower deck contains, besides accommodations for 22 passengers, a toilet room and a small space where drinks, sandwiches, and other refreshments and food are served. The upper compartment has seating accommodations for eight persons, and is used as a smoking room.

Fighting Forest Fires from the Skies

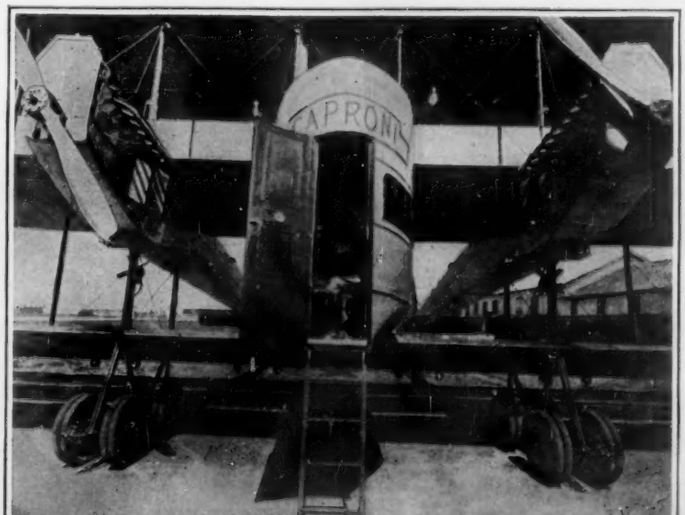
THE chance to furnish invaluable military training for aviators and at the same time to perform a useful peace-time service is now offered in our great Western timber preserves. The annual loss by fire in our forests is enormous, despite the precautions taken to discover the fires as soon as they start and put them out before they can get under headway. There are patrols on foot and on horseback, and also on motorcycles which are constantly travelling over the forest lands ready to put out a blaze when it appears. Lookouts are stationed at high points to watch for smoke, but the vision of these lookouts is necessarily limited. The regions are vast and hence it is impossible to cover them thoroughly, so that fires frequently get a head start and reach serious proportions before the fire fighters can reach them.

In order to enlarge the field of observation balloons are now being used for lookout posts and these rising high above the forests give an excellent view of surroundings for scores of miles in all directions. They are in telephonic communication with fire stations so that they can report a fire at once and send the fire fighters to the scene.

But the balloons do not provide complete protection and so observation airplanes are now being used. These travel at a considerable elevation and can circle over a very wide area. They can travel as far in an hour as a patrol could travel in three or four days. When a fire is discovered the fact is signalled to the nearest station. In some cases a message is dropped by parachute. The latest development is to equip the machines with wireless outfits so that they can telegraph their discoveries immediately. The airplane forest scouts keep in excellent practice and should prove useful in time of war.

Time is the most important element in this work and even though airplanes are speedy and can make their report instantly by wireless to the nearest stations it takes time for the men to reach the scene of the fire. What is needed is some first aid treatment to check the fire until the real fire fighting forces can arrive. It has been proposed, therefore, that bombing planes be used, fitted with bombs containing gases that smother fire. The fires then can be fought just as the Huns were fought by means of gas attacks. Carbon dioxide or some other gas dropped on the fire will smother it, and if the blaze is discovered in its early stages a few bombs may quench it completely. At any rate a fight can be started on the fire as soon as it is discovered, instead of waiting a long time for the fire fighters on the ground to reach the spot.

This idea of bombing fires is not only a very practical one from the point of view of the forest preservation, but it affords just the sort of training that our aviators need and it gives them practice in dropping bombs on a definite target, so that in time of war they should be able to do excellent service against the enemy. The only difference [illegible] fact that the enemy in this case does not fire back, and the aviator thus has a chance to get to close quarters without danger.



Near view of the passenger-carrying Caproni triplane with the door to the cabin left open and the ladder in place

Silver

THE high price of silver has caused the reopening of old silver mines in the West which are being developed in anticipation of continued high prices. The production from these mines will tend to offset the loss caused by the reduction in copper output. The silver produced as a by-product of copper mines has amounted to a little less than one-third of the silver produced. Therefore, a reduction of 30 or 40 per cent in copper output would mean a reduction of about 10 per cent in the total output of silver. In order to make up this deficit it would be necessary for the silver mines to increase production by about 30 or 40 per cent. Whether this increase will be realized is problematical. This increase would amount to about 7,000,000 ounces a year, and it does not appear likely at present that this can be realized this year.

The export market for silver seems almost unlimited. Both China and India are in the market for large amounts. The Indian situation is almost acute. Large quantities of silver have been imported into India in recent years which have been swallowed up and disappeared from circulation, owing to the hoarding custom of the country. India is again in need of silver and it is rumored that another large consignment will be sent there from the United States.

The large consumption by India has created a shortage in the market for use in other countries. Many inquiries for the purchase of silver for foreign markets have been reported owing to the removal of restrictions on the exportation of silver, and the surrender of control by England.

The situation has caused a movement in the United States toward the organization of a silver export association to control the export price of silver. In the past England, as the largest purchaser, has been in control of prices. At present it may be possible for the United States to control prices.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A Three-Foot Saw Which Fits in Any Pocket

A YANKEE doughboy has recently brought home the interesting saw shown in the accompanying illustration, which he captured from a German. The saw is an ingenious tool made of small links of very high-grade steel, provided with sharp teeth. It will readily cut a way through a wire entanglement, or it will fell a tree in a few minutes. When stretched to the limit it measures a yard, but folded it will fit into one's pocket.

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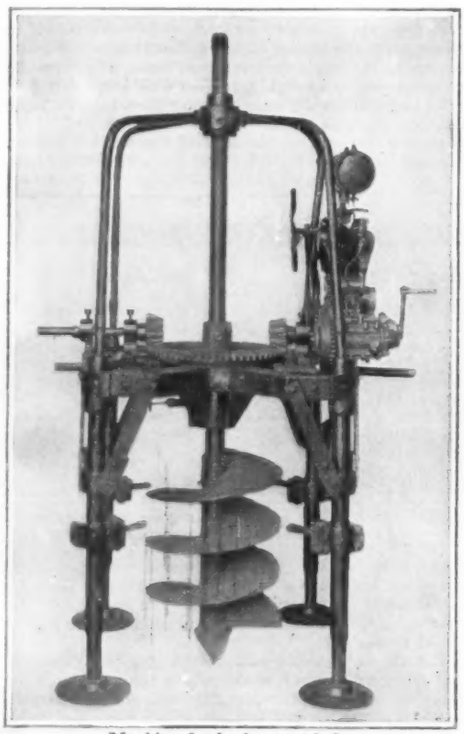
This flexible saw, employed by a German soldier for cutting wire entanglements, measures three feet in length when fully extended

Power-Driven Auger for Boring Post Holes

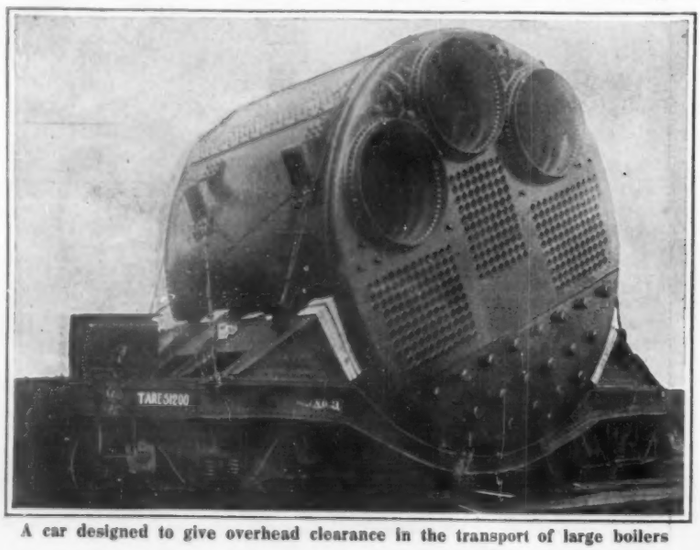
AN ingenious post-hole digger has been invented by Lee N. Holscomback of Dallas, Texas, which is illustrated in the accompanying engraving. It is a machine which is comparatively light and may be readily transported from place to place. A small gasoline engine furnishes the power for driving the auger. As is clearly shown in the illustration it consists of a frame with four adjustable legs which may be adapted to uneven ground. The auger consists of a long threaded stem with a spiral flange at the lower end. On account of limited space we have cut away the stem in the engraving, but it will be understood that it extends far above the frame, so as to permit the digging of a deep hole. On the stem there is a large bevel-gear provided with a key or feather, adapted to slid in a groove or keyway in the stem. To the right is the motor which drives the bevel-gear by means of a pinion. There is also a pinion on the opposite side which may be driven by a crank handle in case it may be necessary to use hand power, owing to failure of the engine. When the gear is revolved it causes the auger to revolve and as the stem passes through a fixed threaded sleeve below the bevel-gear the auger is fed down into the ground. As the hole is being bored the earth is automatically carried out by the spiral flange. After the hole has been bored to the desired depth the auger is lifted out without turning, so as to leave a clean hole. This is accomplished by removing a set screw in the fixed sleeve and securing the latter to the bevel-gear so that it revolves with the gear. The key is taken out of the keyway in the auger stem and then, on operating the mechanism, the auger rises without turning.



Machine for boring post holes

Shipping Large Marine Boilers

THE extent to which the size of marine steel boilers has expanded is shown by the illustration. It represents one of 30 large boilers, 14½ feet in diameter by 11 feet 2 inches in length, which are being transported by rail for installation in 15 vessels building at various points on the Great Lakes. Up to very recently it was impossible to ship boilers over 11 feet in diameter from Oswego, N. Y., where the foundry is located, except by canal. The special car shown in this illustration, however, makes it possible to transport boilers of the dimensions stated. These boilers weigh about 91,000 pounds each; two are carried in each 3,500-ton ship. The car shown is built so that the bottom of the I-beams are only one foot clear of the rail. The allowance is necessary to get clearance under bridges and in tunnels. In some instances, in fact, the boilers have clearance of only one inch, and must therefore be loaded very carefully and centrally.



A car designed to give overhead clearance in the transport of large boilers

The Trade-Mark "Liberty" Registered by the United States

By Capt. William L. Symons, Air Service, U. S. A.

A CERTIFICATE of registration of the trade-mark "Liberty" as used on airplane engines was granted by the United States Patent Office to the United States of America, on June 17th, 1919. This is the first instance of the Government of the United States registering a trade-mark under its own trade-mark laws, or the laws of any other country, although other governments have registered their marks in the United States Patent Office for the goods on which they are used. The Republic of France has registered marks used on cigarettes and several registrations have been granted by the United States Patent Office to the Imperial Government of Japan. Some Government activities, such as the War and Navy Departments Commission on Training Camp Activities, have been granted registration of their trade-marks.

Everything connected with the history of the mark "Liberty" as used by the United States on its airplane engines is unique. When the Liberty Engine was first developed in the summer of 1917 it was referred to by the Government Engineers as the "United States Standard Aircraft Engine" or the "United States Standard Engine." Some genius, however, selected the right word and all the district offices of the Bureau of Aircraft Production which was then the Equipment Division of the Signal Corps were soon notified that the use of the word "Liberty" as applied to the new engine was so popular that it seemed inadvisable to attempt to use any other name. This word was a happy selection.

Trouble resulted in a short time, however, from the great popularity of the word "Liberty" as applied to articles of commerce. Many manufacturers began to designate their goods by the term "Liberty." This use of the term on goods which are of the same general class as engines or on goods adapted to be used on engines, resulted in confusion and probably in deception. Government officials soon saw that it was necessary to protect the name. After considering several ways of getting the best protection of the right of the Government in the use of the word "Liberty," the plan of registering it in the United States Patent Office under the United States Trade-Mark Law was adopted. These proceedings resulted in the grant of certificate of registration No. 125,853, which under Section 16 of the Trade-Mark Act constitutes prima facie evidence of ownership of the mark "Liberty" as used on engines and parts thereof.

The certificate of registration is a rather curious document. It recites that:

"The United States of America, a corporation having its seat of Government at Washington, District of Columbia, and doing business at said Washington, District of Columbia, and elsewhere, has adopted and used the trade-mark shown in the accompanying drawing, for internal-combustion engines and parts thereof, in Class 23, Cutlery, machinery, and tools and parts thereof.

"The trade-mark has been continuously used in the business of said corporation since on or about July 4th, 1917.

"The mark is applied or affixed to the goods by attaching a name plate thereto on which the trade-mark is shown.

UNITED STATES OF AMERICA,
By WILLIAM C. POTTER,
Acting Director of
Bureau of Aircraft Production.

Work for Disabled Soldiers

THE Australian Government has paid £50,000 (nearly $250,000) for the use of the patent and for two complete units of a reed-weaving machine of American make. Public criticism on the grounds of the extravagance of the transaction has been severe, but the Government has issued a pamphlet giving its reasons for the purchase.

There were imported into Australia in the years 1911, 1912, and 1913, respectively, $90,000, $100,000, and $63,000 worth of articles made of wicker, reed, cane, etc. It is believed that with the aid of this machinery the demand can be satisfied without importations. Under this scheme disabled soldiers who have lost an arm or leg in the service, or those who have suffered in other ways, will be definitely helped in their fight to earn a living.

A Terminal on the Jersey Flats

(*Continued from page 103*)

will likewise be ample. The present pierhead and bulkhead lines, as established by the New Jersey and the Federal authorities, are, respectively, roughly at the outshore three-quarters and at the mid-section. Because of the physical nature of the harbor bottom and the contour, it would not be feasible to develop the property without a modification of pierhead and bulkhead lines. In the absence of such changes, it would naturally devolve upon the Federal government to dredge the entire area from the present channel back to the existing pierhead line. Since this would involve an expenditure of some millions of dollars, while the space in question can be more effectively utilized by bulkheading and filling, the space for actual navigation allowed by the project is ample.

In the plan therefore the coal bunkers are located on rock along the proposed bulkhead line, outshore of the present pierhead line. The ship-repair plant is located at the northerly edge of the property, adjacent to the oil works and the National Docks, not only because it will lead to less congestion of traffic in the dock slips, but also in order to make use of existing rock foundations for the graving dock. The piers and slips on the southerly edge of the property were designed adjacent to a wide channel and also with reference to the sub-surface rock so as to minimize the cost of excavation. However, the presence of this rock makes it possible to erect multi-story pier sheds, specially designed, for expediting the loading of outgoing vessels. The inshore slip is to be used for lighterage and barge-canal business requiring less depth of navigable water.

In the drawing herewith, a perspective view of the completed development is given. Commencing at the upper left-hand (southwest) corner are seen the railroad roundhouses, with space for a minimum of 50 locomotives. Next, coming east, are the barge and lighter docks, consisting of two piers with landings on both sides and bearing large warehouses. Dredging to a depth of 30 feet would be practicable here if necessary. The regular steamship piers are next, eastward toward the open bay; of these there are three of 1,500 feet each, with six to eight-story superstructures, and two open piers. All these have slips on both sides.

Coming on to the northeast corner is the fuel-oil supply station, containing three tanks, each with capacity of several million gallons, connected by circulating pipes to ship berths over a large wharf frontage; also heating and lubricating oil plants. The all-important coal equipment occupies the east frontage, with 2,400 lineal feet of pockets. The system here is an elaboration of that at Newport News, which has already been described in these columns.

Next along the east frontage, to the northward, is the carfloat terminal, which connects directly with the great freight car classification yards extending backward the entire two miles of the tract. There are five double slips for the car floats, a new feature being trackage on long piers between the slips to permit of storage of cars to prevent delays. Next come the truck ferries and transfer sheds for accommodation of teamsters, so that goods received direct via dray can be transferred to all parts of the harbor. Direct connection will be established between trucks and cars, with roadways, ramps and overhead bridges provided for all vehicles, and grade-crossings wholly eliminated.

At the northeast corner are the grain elevators, with special provision for handling barge traffic and extensive pier sheds and warehouses for use of craft from the up-state canals. Next on the northerly side is the ship repair plant, extending to the oil works on the mainland.

Adjoining the railroad tracks near the outer extremity of the track at the northwest corner is the free zone, where raw materials may be brought in and manufactured products taken out free of duty. As far as the shipper is concerned, the status of this zone is the same as that of a barren rock in mid-ocean over which no power claims jurisdiction. He can transship goods here to his heart's content without any annoyance from the United States Customs. Adjoining the free zone to the west is a million square feet of ground set aside for general factories of all kinds.

It will be noted that the plans provide quite generally for oblique piers to permit ships to berth themselves without the aid of tugs, and to back out to the open bay under their own power.

The full operation of the various industries of the tract, it is estimated, will employ about 50,000 persons.

Fabricated Lumber and the Housing Problem

(*Continued from page 107*)

screw in place about 1,000 feet of lumber a day, and for this service his compensation averages in the neighborhood of $10 per diem.

The man that has achieved this extremely promising revolution in the lumber industry and, reflexively, in the building trade, is E. A. Laughlin of Port Arthur, Texas. He has made a dream come true. For some years back he was inspired by the belief that somewhere or somehow there would develop a method of producing the ideal home or dwelling from lumber in a machine-made, finished form, accurately cut to fit, and ready to use substantially without the employment of the carpenter's saw, chisel, or plane. The task of accomplishing this fell to him. The materials now produced by his method lend themselves to the construction of widely different looking homes, although fabricated out of standardized parts.

Substantially no restrictions are placed upon the architect or the prospective owner. The house can have either a hip or a gable roof, the only limitation being acceptance of a common pitch. Again, the supports for floors or joists, the vertical frames or studs, the rafters, and the dimensions of windows must harmonize with two or three standards from which a choice can be made. Otherwise, like a well-known mechanical toy, the building units admit of an extremely varied arrangement. That is to say, the architect is no more hampered in the designing of a pleasing and individual frame house with these new materials than he would be in employing bricks, which are of fixed proportions.

Starting at the saw mill, where special machinery is installed and where thin saws are used which cut so close and cleanly that the surface is well-nigh as smooth as if planed, the standardized sills, joists, plates, studs, rafters, etc., are turned out at the desired lengths and accurately mortised and tenoned, so that they will make perfect fits and can be joined securely together with about one-third the number of nails commonly required. By this process of manufacture, short-length pieces of lumber can be worked up into a higher grade of material at the mill; and transportational charges and wastage at destination are greatly reduced because the shipping weight is cut to a minimum and the structural elements are dimensioned to a nicety.

As most of us know, the best of antique furniture owes its strength fundamentally to the skilful fashion in which its parts were joined together by dovetailing. The ready-to-assemble, standardized lumber is in the main similarly united, to just that extent cutting down labor costs in erecting and the outlay for nails. The machines that do this preparatory work have a daily capacity of 10,000 feet of finished product as against 650 to 700 feet—the work of the ordinary carpenter during an average day. The lock joint employed is of a special design consisting of a tapered tenon which enters a dovetailed, tapered dado.

(*Continued on page 119*)

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Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Of General Interest

HANGER FOR SLIDING DOORS.—J. H. STEWART, care of G. W. Elkins, 34 Pine St., New York, N. Y. The invention has for its general object to simplify the construction and operation of devices for slidably hanging laterally sliding doors, the device being of comparatively inexpensive construction, reliable, and so designed as to permit a movable door section to be supported on a fixed door section without the use of overhead supports.

AUTOMATIC FIRE-THROWER.—A. E. SEIDLER, Railway Exchange Bldg., Chicago, Ill. This invention has for an object the provision of an apparatus which will utilize the power created by the explosion of a shell of a rifle or a rapid-fire gun for projecting burning fluid. A further object is the provision of means for utilizing power from a rapid-fire gun or other gun and causing the combustible gases from the gun to not only project the fluid, but provide a flame for igniting the same.

POCKET BOOK.—W. A. SMITH, 1115 Ingsham St., Los Angeles, Cal. The invention has for its object to provide a pocket book formed from a single piece of flexible material, as for

A PERSPECTIVE VIEW OF THE BOOK OPEN

instance leather stitched together only at the side edges and wherein large compartments are provided for bills and small compartments for coin and the like; there are no metal clasps or hinges to wear the pockets or to scrate hother articles in the same pocket. The book remains closed by folding, no bands or connections being required.

PACKING OF PHOTOGRAPHIC RAW-FILMS.—J. P. HANSEN, Copenhagen, Denmark The main object of the invention is to provide a packing device which may be sold singly and is easily transportable, that development may be undertaken at any time without it being necessary to await the taking of the remaining films, and that films may be developed singly so that they may be given different treatment in order to adjust the exposure.

PHOTOGRAPHIC CAMERA.—J. P. HANSEN, Copenhagen, Denmark. The invention has for its object to provide a camera adapted to be used with film packings and plate packings, which consist of an envelope with cover plate and provided with a projecting edge, which envelope may, when closed, be introduced in the camera, and kept fast there during the displacement of the cover plates, to be taken out again when the exposure has been finished.

TOOTH BAND.—J. E. JOHNSON, 611 Atherton Bldg., Louisville, Ky. The object of this invention is to provide means for fitting on tooth bands for holding straightening devices and the like on teeth, wherein the band will be formed of a suitable metal having a smooth surface on the lingual side that will not irritate the tongue. Means is provided for fitting the bands, and removing them for soldering to be afterward replaced.

APPARATUS FOR DEVELOPING, FIXING AND WASHING OF PHOTOGRAPHIC FILMS AND PLATES.—J. P. HANSEN, Copenhagen, Denmark. The invention relates to an apparatus for developing, fixing and washing a film or plate in an envelope having a flexible cover, the device may be inserted and the development done in full daylight, a considerably smaller quantity of solution being needed, owing to the form of tank used.

MACHINE GUN FOR SHOTIONG GALLERIES.—W. F. MANGELS, 2863 W. 8th St, Coney Island, N. Y. The object of the invention is to provide a machine gun designed for use in shooting galleries, and arranged to enable the proprietor of the establishment to quickly place a cylinder filled with a number of cartridges in position on the gun and to enable the user to fire the cartridges by turning a crank, at the same time permitting the user to aim at distant targets. Other objects are to limit the pointing movement to prevent injury to bystanders, and to reduce the danger of clogging the gun.

HOLDER.—O. E. DROEGE and G. A. ROBINSON, 230 W. 123d St. New York N. Y. The object of the invention is to provide a holder more especially designed for holding brooms, shovels, rakes, handled tools and other tools and implements and arranged to permit convenient adjustment of the holding members to accommodate tools and implements of small or large diameters. Another object is to permit of conveniently and quickly placing the tools in position or removing them therefrom whenever it is desired to use them.

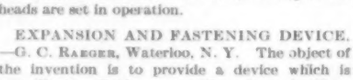
ADJUSTABLE BED.—M. NOVICK, 475 Sixth Ave., New York N. Y. The invention relates to furniture and has particular reference to beds, couches, cots, or the like. Among the objects of the invention is to provide a bedstead or frame and spring mattress both adjustable longitudinally and laterally and with means carried by certain of the parts and cooperating with the remaining parts to make secure the adjustment in any position.

WATER FLOW ALARM.—L. LEITMAN, 75 Mechanic St. New Rochelle N. Y. This invention relates to indicators that are calculated to give notice or warning to a superintendent or owner that a flow of water is taking place in a pipe line. The prime object is to provide certain attachments to a stand pipe that is intended to convey water in or through a building equipped with automatic sprinklers, the water being normally static in the stand pipe but adapted to flow when one or more of the automatic sprinkler heads are set in operation.

EXPANSION AND FASTENING DEVICE.—G. C. RAEGER, Waterloo, N. Y. The object of the invention is to provide a device which is exceedingly pliable to readily adjust itself to irregularities that may be in the wall of the hole in which the device is used. Another object is to permit of providing an expansion device for use in comparatively small holes, and to permit the use of the expansion device in stone concrete wood, metal, and other materials.

PACKING BRICKS FOR TRANSPORTATION.—W. T. HOOKEY, 605 W. 141st St., New York, N. Y. The object of the invention is to provide a device for packing bricks for transportation, storage or other purposes, and whereby the repeated handling of the single bricks from the time they leave a brickyard until used by the bricklayer on a building or other structure is entirely dispensed with and the cost of labor reduced to a minimum, while the bricks are not liable to be injured during the loading or unloading or in transportation.

FRENCH FOUNTAIN PEN.—A. LAWRES, 457 Williams Ave., Brooklyn, N. Y. Among the principal objects which the invention has in view is to illuminate a limited area of the surface on which the pen is writing and at the under side of



A LONGITUDINAL SECTION OF PEN CONSTRUCTED WITH THE INVENTION

the nibs thereof, to concentrate the light emitted from the illuminating member so as to avoid its being from above. The light though concentrated to a relatively small area, is in the desired space and therefore serves to the best advantage.

ASH SIFTER.—J. ROSSI, New Milford, N. J. The object of this invention is to provide an ash sifter more especially designed for household use and arranged to enable the operator to quickly separate the ashes from the coal and cinders and without danger of any dust passing into the room from the sifter during the sifting operation. Another object is to permit of readily removing the separated ashes after the sifting operation is completed.

LADY'S POCKETBOOK.—J. STEMBER, 821 Broadway, New York, N. Y. This invention provides a pocketbook having a bill pocket arranged in such a manner that the user can readily place bills therein and close the pocket to render the bills invisible on opening the pocketbook. Among the objects is to hold the bills in flat condition one on top of the other thus enabling the owner to readily select a bill of the desired denomination for removal from the bill pocket whenever desired, and to provide a bill pocket which is not unduly bulky.

MACHINE-GUN.—J. F. O'MALLEY, 83 W. 128th St., New York, N. Y. The invention has for its object to provide a rapid-fire machine-gun which is extremely simple in construction. The gun is provided with a double reversible barrel which may be adjusted to permit one barrel to cool while the other barrel is in use, and rapidity of fire may be regulated by the adjustment of the gears which connect the operating member with the loading and firing mechanism.

SCRUBBER, CLEANSER AND COOLER FOR GAS.—D. J. SMITH, London, England. The invention relates to devices used in connection with gas producers either suction or pressure operated, the gas being thus either drawn or forced through the scrubber. The objects are to reduce the size and weight of the scrubber, to reduce the resistance by friction or back pressure on the gases passing through the scrubber, to render the apparatus suitable among other purposes for use on motor vehicles propelled by internal combustion engines operated by suction gas.

GUIDING AND CONTROLLING INSTRUMENT FOR CUTTING CLOTHES.—J. BARODY, Constantine, Algeria. The invention relates to a tailor's drafting instrument, the object being to provide an instrument so constructed with the inclusion of transparent panels and suitable scales, that a garment may be laid out with a cutting outline, from previously prepared data showing the principal controlling points in the anatomy of the person. Another object is to provide a device consisting principally of a plurality of transparent graduated hinged panels, to enable the fixing of certain points on a garment.

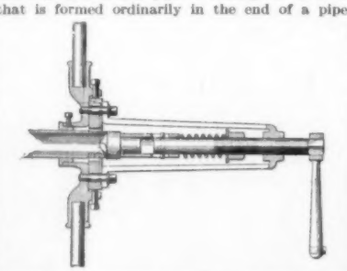
VALVELESS SYRINGE.—F. S. DICKINSON, care of Becton Dickinson Co., Rutherford, N. J. The object of the invention is to provide a valveless syringe arranged to permit the user to readily draw the liquid into the barrel and to prevent the liquid from passing into the rubber bulb on holding the syringe with its nozzle upward and with the liquid resting on the normally closed entrance to the bulb. Another object is to provide a syringe of simple construction and of few parts which may be quickly and thoroughly sterilized.

SASH HOLDER FOR WINDOWS.—C. NYSTROM, 1629 Plymouth Ave., Westchester, N. Y. This invention has for its object to provide a sash holder for windows arranged to permit of securely holding the sash against rattling. Another object is to permit the user to conveniently adjust to holder to allow raising or lowering the sash and to permit of conveniently applying the device to a window sash without materially altering the construction thereof or that of the window casing.

WOVEN CARTRIDGE BELT.—W. ACHTMEYER, 29 Wall St., Middletown, Conn. The object of the invention is to provide a woven cartridge belt which is exceedingly strong and durable, cheap to manufacture, and provided with pockets of uniform shape for properly holding the cartridges in shape. Another object is to permit of weaving the cartridge belt on an ordinary chain head loom instead of special looms such as are used for making cartridge belts with integral fashioned pockets.

Hardware and Tools

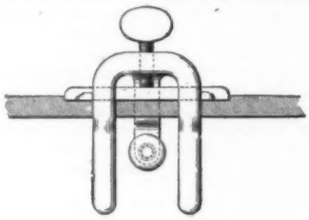
PIPE REAMER.—T. P. SALLEY, 188 Clarkson St., Brooklyn, N. Y. This invention relates to tools for manipulating or operating upon metal pipes: it has particular reference to means for reaming the end of a pipe or cutting off the burr that is formed ordinarily in the end of a pipe



VERTICAL LONGITUDINAL SECTION OF THE DEVICE IN OPERATIVE POSITION

coincidentally with the operation of the pipe cutter. Among the objects is to provide an apparatus in the nature of an attachment foe a standard type of pipe stock employed for thr cutting of a thread on the outside of the end of a pipe, and providing means for the passage therethrough of electric wires or the like without obstruction

SAW JOINTER.—F. M. BOULT, % Simplex Saw Co., Osterville, Mass. This invention relates to saw jointers or tools for dressing down the points of saw teeth so as to make the teeth all of the same length or depth. Among the objects is to provide a jointer comprising a file holding implement having a yoke shaped bracket constituting the main portion of the implement, said

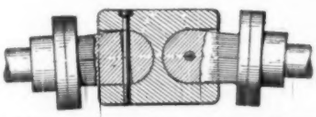


SIDE ELEVATION OF DEVICE WITH THREE-CORNERED FILE CLAMPED THEREIN

bracket comprising a plurality of depending legs for operation on opposite sides of the saw. A further object is to provide means whereby the jointer automatically accommodates itself to different thicknesses or gages of saw blades.

Machines and Mechanical Devices

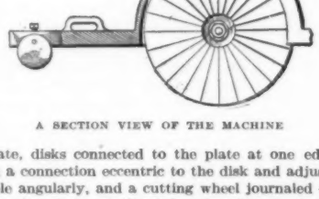
SHAFT COUPLING.—G. T. NELSON, Orange, Texas. The object of the invention is to provide a device primarily designed for installation on the shafting of steamships, but applicable on any line of shaft where the line is not direct from drive to



A LONGITUDINAL SECTION OF THE COUPLING

driven. The coupling comprises a block having recesses in its ends, the recesses being square in cross section and having rounded bottoms, the shaft sections having heads engaging the recesses and shaped to fit the same loosely, each head, being tapered toward the shaft section to permit angular movement of the shaft with respect to the block, and means connecting the head to the block.

JOINT TRIMMING MACHINE.—J. G. LAURENTS, Box 111, Lake Arthur, La. The object of this invention is to provide a machine capable of being controlled by hand, for trimming the joints in the decking and planking of wooden hull vessels. The device comprises a supporting



A SECTION VIEW OF THE MACHINE

plate, disks connected to the plate at one edge on a connection eccentric to the disk and adjustable angularly, and a cutting wheel journaled on the plate between the disks, the plate having a guard covering the upper edge of the wheel and the adjacent portion of the cutting face.

Designs

DESIGN FOR A CONTAINER FOR TOILET AND OTHER POWDER.—C. S. HUMPHREY, care of Manhattan Can Co., Bush Terminal No. 10, Brooklyn, N. Y.

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Fabricated Lumber and the Housing Problem

(Continued from page 117)

These tenons are on the opposite faces at the ends of the studding, joists, etc., and, therefore, there is no right or left to be considered—either end will fit the designed mortise. Because of this feature, assembling becomes foolproof.

Probably no better evidence of this is needed than the fact that very large quantities of this standardized lumber have been shipped to Mexico, where the laborers were unskilled and could neither read nor write. The different parts were painted a distinctive color on one end, and similar colors were marked on the blueprints which designated the locations for the pieces. In this simple fashion the peons were guided, and the structures were reared correctly and with creditable speed. As a matter of test, buildings of this lumber have been erected in this country by blindfolded mechanics; and recently a string of houses seven miles long was put up of this novel, standardized material.

During our participation in the European conflict, the United States Government employed this lumber extensively for war construction work both here and abroad because of its time-saving, freight-reducing characteristics. Today, the Federal authorities have released their exclusive claim upon the system, and the home builder, face to face with the problem of making his dollars go as far as possible, can now have recourse to this fruit of native cunning. Further, this new order of standardized product makes it possible, thanks to the conservation effected at the saw mill, to utilize much lumber which would be counted largely a loss at the building site if delivered there in the usual lengths and marred by natural defects. Therefore, we have in this example of efficiency, brought to a climax through stress of conflict, a commodity which will do much to solve the nationwide housing problem and, incidentally, lead to many material economies and enduring benefits. Every log will henceforth give a fuller measure of satisfactory, usable lumber.

Disposing of Ashes with Steam

(Continued from page 111)

half of the pipe sections. After the pipe line has been in service for the removal of several thousand tons of ashes it may be turned over so as to present a new wearing surface, and at the same time the liners are renewed. At the point where the steam is injected special provisions are made to take care of the wear, which at such points is a maximum because the stream of ashes must make a sharp turn to the vertical direction. The same is true of the elbow at the top of the vertical portion of the pipe. Here special liners are provided of wear-resisting material and the parts are so arranged that they may be readily renewed. Each plant has its own peculiarities that one standard installation will not fit all cases. Special joints and steam units are provided, in some of which the elbow instead of making a short turn consists of a long sweep.

One of the important advantages of this system of disposing of ashes lies in the fact that boiler rooms are kept clean. In fact dust-free boiler rooms prove a considerable inducement when hiring new men.

The Craters of the Moon

(Continued from page 114)

groups, under the names walled-plains, mountain-rings, ring-plains, crater-plains, craters, craterlets, and crater-pits.

Whether or not all of these various forms have been produced in the same way is a question. At present there is no consensus of opinion as to their origin. Many theories have been advanced, several of which in brief outline follow.

The ice theory, suggested perhaps by the resemblance of some portions of the moon to an ice surface seen from a distance, supposes that formerly the moon was covered with pools of water kept in the liquid condition by heat from within. The water evaporated, but, on account of the low temperature of the surrounding atmosphere, was quickly deposited as snow, forming a crater wall.

This theory has little to commend it. It does not account for the central peaks, so often found within craters, nor for the steepness of the crater walls. If composed of ice, the walls would have flattened out long ago in the process of glacial flow.

A second theory is based upon tidal action. Just as the moon causes tides upon the earth, so the earth produces an ebb and flow in all parts of the moon which are not perfectly rigid. At some stage in its history the moon is supposed to have been in a molten condition. According to the tidal theory, as the moon cooled, a crust began to form on its surface, and, while there were still holes in it here and there, tidal forces caused an ebb and flow of the magma. At each high tide the lava rose through the opening and spread for some distance over the crust and then receded as the tide ebbed, but, as a result of cooling and hardening, some of the magma remained on the surface in the form of a ring around the opening. At each subsequent tide more material was deposited, until a typical circular crater wall was formed. As the opening became smaller, and the magma cooler and thicker, a central peak may have been built up.

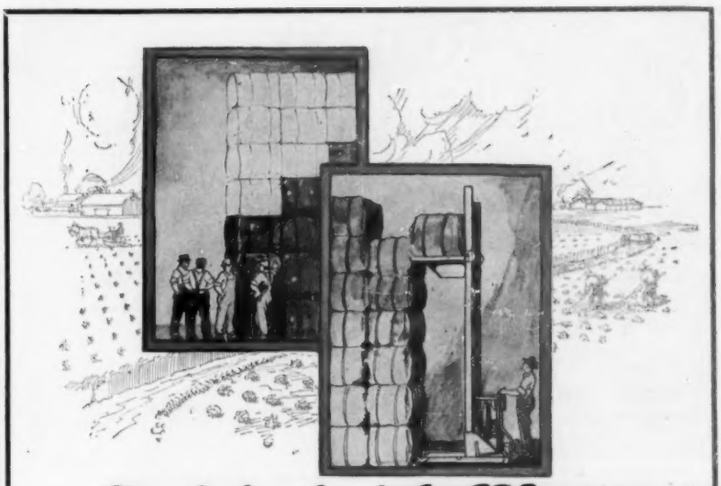
It is quite possible that some of the craters may have been formed by this process, but it is difficult to see how such a complex system of overlapping and intersecting formations—as are shown in our third figure—can be accounted for in this way.

A third theory is based upon the marked resemblance between the lunar craters and the pits formed by dropping balls into soft mud or mortar. This may be called the meteorite theory, or, in its modified form, the satellite theory. The earth in its journey through space encounters thousands of fragments of matter. Many of these, as they dash into our atmosphere, are burned up by friction, and we see them as shooting stars, but many are large enough to pass completely through the atmosphere, and actually strike the earth. Of those which have been seen to fall, the largest weighs between six and seven hundred pounds.

The moon also must be struck by meteoric matter, and, according to this theory, what we see on the moon is the effect of such a bombardment at the time when the moon's surface was just beginning to solidify. If the craters were really formed in this way, the masses which produced them must have been much larger than any meteorites with which we are familiar. Judging from the size of the craters, several of the masses must have been somewhere about one hundred miles in diameter, that is about the order of size of the largest of the asteroids, and there must have been at least 50,000 with a diameter greater than half a mile.

The meteors which strike the earth are moving, singly or in swarms, around the sun and have an average velocity of 26 miles a second. Now meteors large enough to produce such effects as we see upon the moon, and moving with a velocity of even four or five miles a second would generate so much heat that not the slightest trace of the impact could possibly remain. Not only would the meteor itself be completely melted, but also any crater walls that it might form. Moreover, meteors moving in this way would strike the surface at all angles and if craters could be formed, the greater number of them would be elliptical, or rather oval in outline.

To overcome these two objections to this theory, it has been suggested that formerly the earth may have been surrounded by a swarm of small satellites, similar to those which form the rings around Saturn. The moon would be in the midst of the particles or masses of this swarm and moving at approximately the



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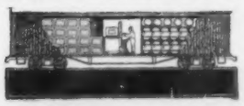

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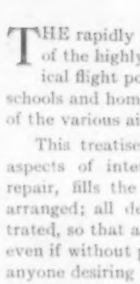

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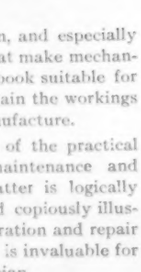

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same rate. For a long time these little satellites would keep pace with the moon, but, eventually, on account of its greater mass they would be drawn down upon its surface and would strike it, in general perpendicularly, and with a velocity not exceeding 1.5 miles per second. This is the velocity which the moon can impart to a body falling from infinite space.

If such a swarm ever really existed, unlike the rings of Saturn, it has long since vanished. No trace of any terrestrial satellite except the moon has ever been discovered. Many of the little masses may have been swallowed up by the moon, when it was still in a fluid or gaseous condition, and we must assume that those which left their impression on the face of the moon were about the best of their kind.

Many of the details of the lunar topography can be reasonably explained by this theory, but there is one conspicuous exception. Wherever the craters are very thick, as in our third cut, it may be noticed that many of the ring-walls or craters intersect, and it is always the smaller crater that overlaps the larger, whereas, according to this theory, the smaller masses would be captured by the moon first and the larger craters would overlap the smaller.

Still another theory assumes that, just after the surface of the moon began to solidify, through pressure from within, due, perhaps, to the generation of gases, the thin crust was bent up in the shape of a dome burst outward. Some of the fragments of the crust fell back into the glowing interior and were melted again, but around the opening a circular wall remained standing. Gradually the surface within the ring cooled and hardened and a typical crater or ring-mountain was formed.

This theory may have been suggested by the formation and bursting of steam bubbles on the surface of a thick cereal or other viscous mass when cooking, or, possibly, by the fact that pits or craters frequently appear on a mass of iron when it is cooling. It is, indeed, difficult to conceive of bubbles one hundred miles or more in diameter, and, moreover, if this process has really played a prominent part in the development of the luner topography, it is strange that there remains not a single unbroken dome, formed during the later stages of lunar activity, when the crust had become thicker and more rigid.

Finally, we come to what would seem to be the most natural theory, namely that the lunar-craters were formed in very much the same way as some of the volcanic craters on the earth, but even this theory encounters difficulties, especially in case of the great ring-plains. Some of these are so extensive that a person standing in the center could not see the summit of the surrounding ring at any point.

The force of gravity on the moon is but one-sixth as great as that on the earth, and this may possibly explain, at least partially, the great difference in the size of the terrestrial and lunar craters.

Volcanoes on the earth are of two distinct types, differing both in form and action. One type, illustrated by Vesuvius, Etna and Fujiyama, is characterized by a steep conical peak with a relatively small crater near its summit. In general, volcanoes of this type remain for a long time dormant or quiescent, but occasionally burst forth in great fury and eject steam, gas, ash and lava. In the other type, illustrated by Kilauea and Mauna Loa on the Island of Hawaii, there is an almost constant flow of magma, oozing out through various openings. Great explosions do not occur, nor is a great conical peak built up. Their craters are broad and low, and are constantly being enlarged by the faulting and slipping in of their sides. Their crater floors are below the general surface level. In this respect as well as in general appearance they resemble the lunar craters. No perfectly symmetrical cones with crater summits are found on the moon. If, therefore, the lunar forms were produced by volcanic action it would seem to have

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been of the Hawaiian type rather than of the Vesuvian or explosive type.

Such then are some of the theories of the lunar craters. The difficulty of verifying any one of them is due to the fact that the process of crater formation is no longer going on. How long ago the moon cooled to its present perfectly rigid condition we can only guess, but it can be said definitely that no appreciable change in its topography has been detected since it was first studied with telescopes 300 years ago.

Rare Metal From Pyrites Flue Dust

WITH the object of utilizing waste products, two British experimenters tried to extract selenium from the flue dust of the sulfuric acid plant of the Blaydon Chemical Works. They failed so far as selenium is concerned, but they found some thallium. The flues in question serve for conducting the sulfur gases from the pyrites kiln to the Glover towers, and have to be cleaned periodically. The kilns are charged with copper pyrites from Spain, which contain, in addition to about 2 per cent of copper, a large number of other elements. The more volatile of these, arsenic and selenium, pass with the sulfur beyond the flue into the Glover tower. In the flues collect dust of iron oxide, small quantities of lead and copper, and volatile products condensed at about 450 deg. C., such as antimony, bismuth, thallium, etc. Thallium is not a rare element, but it occurs, always in small quantities, associated with other metallic sulphides, in various ores. It is not found in all pyrites, and though the sulfuric acid dust may contain up to 8 per cent of thallium, the percentage rarely exceeds 0.25. That was the amount found at the Blaydon Works (Journal of the Society of Chemical Industry, March 31st, 1919), in the 15 cwt. of dust which had accumulated during six months in which 1,500 tons of pyrites had been burnt. The total yield was only 4 lb. of thallium. The extraction depends upon the solubility of thallium in sulfuric acid (the dust is extracted with the hot acid) and the sparing solubility of the thallium chloride into which the sulfate is converted.

A New Process for the Manufacture and Purification of Peroxide

THE processes at present employed are based upon the composition of persulfates by means of concentrated sulfuric acid. They have the drawback of requiring the preliminary purification of these persulfates by means of crystalization so as to remove the solid impurities which would act as catalysers and cause a loss in yield. This would constitute an operation which, over above the costs of the requisite hand labor and treatment, would always be accompanied by a loss of active oxygen. Furthermore the mixture formed by sulfuric acid and by sulfate resulting from the decomposition of the persulfate by sulfuric acid requires, in order to return to the electrolyzers, the separation of the bisulfate from the free acid.

The following is another process which seems to be much simpler and which consists in collecting the saline deposit of persulfate, which forms during electrolysis, and in submitting it after impregnation with a certain quantity of electrolyte to the combined action of steam, heat, and vacuum. Nearly all the free oxygen is then liberated in the form of peroxide, and the residue of the operation is bisulfate, which may be returned just as it is to the electrolizer, the ratio of the total of sulfuric acid to the basis not having changed.

In practise the crystaline liquid of persulfate of ammonia formed during the course of the electrolysis of a solution of bisulfate is passed through a vacuum filter, until it has acquired a sufficient consistency to be handled, and it is then introduced in this state into a tube placed horizontally and heated externally by means of a steam jacket. The tube itself is traversed by a current of steam and is connected to a vacuum pump by means of a cooling coil and of a receptacle for collecting the products of distillation. The decomposition of the persulfate takes place very quickly and the oxygenated water formed is condensed in the receptacle mentioned above. The residual bi-sulfate is dissolved in a suitable quantity of water and returned to the electrolysers.

In order to purify the peroxide it is distilled under reduced pressure. The product thus obtained is perfectly pure and satisfactory in every way for industrial purposes of every kind.

An Appeal to Inventors

THE War Department, Air Service, Engineering Division, as a result of its experience during the war, has compiled a list of six inventions which are needed by the military aviation units. By request of the Division, we publish a brief summary of what is wanted under each of these heads. Inventors who are interested in trying to fill these needs may secure more complete information by addressing the Engineering Division, as above, at Dayton, Ohio.

In the first place, a tank is desired that will withstand a salvo of 15 shots fired at a range of 30 yards, the ammunition consisting of an appropriate mixture of 30-caliber service, tracer, incendiary and armor-piercing bullets. This test must go through without fire occurring in the tank, and it must be successful on 10 successive attempts with 10 separate tanks. In addition, it is provided that the tanks must not weigh more than 5½ pounds per gallon capacity, and that the fuel must not be stored under reduced pressure.

Another need is for air-bag floats and landing skids. These are to be used by land machines, usually of the light pursuit type, operating over water. The object is to enable such machines to make an effective landing on the water without capsizing, and to remain afloat after doing so. This has ordinarily been accomplished by constructing the landing-gear axle-spacer so as to form a landing skid, and by storing cloth bags in stream-lined housings under the fuselage, together with a tank of compressed air with the necessary piping and valves, and sometimes with an air tank within the fuselage, near the tail. But a more satisfactory design, it is felt, than any now on hand should be possible.

Again, the present portable hangars for field service are usually made of canvas, and are unsatisfactory in that they either blow down in high winds, or leak, or hold pools of water in depressions of their surface, or are too small. Any hangar designed to replace these unsatisfactory articles now in use should be capable of housing at least four De Haviland planes, with room enough left for working on all machines at once. They should incorporate the necessary wiring for electric lights and plugs for extension lamps.

Much is also desired with regard to a suitable gasoline supply gage. The gage should be responsive, serviceable, and *accurate to the last half-gallon*. At present the mounting for the gage can well be left on the tank, as it is thought that the mounting on the dashboard would offer too many complications; still, designs based upon this principle would receive attention.

Perhaps the most immediate need of all is the designing of a single generator and battery which will furnish the power required for the radio installation, the heating and lighting outfit, the ignition, and the motor-driven camera; together with whatever may be necessary in the way of transformers and what-not in order to supply these various units with the electrical energy needed in its proportion and kind. This must be engine-driven in some way, so as to do away with the head resistance of the various wind-driven generators now used. It is almost superfluous to point out that this would be expected to lead to reduction in weight. It is desired especially to have such a design for use with the Liberty Twelve and the Hispano-

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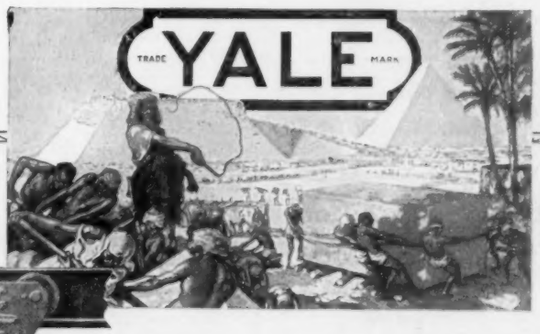

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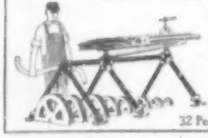

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Suiza; but it is explicity pointed out that those attacking this problem should think not merely of applying their results to existing motors, but also of developing a set of simple general principles to be incorporated in motors of the future.

A mobile independent cranking device is also wanted, to be mounted on an auto truck. This device is to be an electrically driven cranker for planes not equipped with self-starters; it is to be used at the airdome. The general idea which the Service has in mind is a device mounted on a truck that can be backed up to the front end of any plane, and then a flexible arm attached to the propeller. The electric energy is then to be brought into play which will crank the engine and cause it to begin firing. When the engine picks up, the device should automatically be thrown out of connection with the propeller.

Among the data which the Division is prepared to put at the disposal of those who attack this problems is a statement of the previous experiments, so far as known to the Division.

New Way to Detect Over-Heated Bearings

CERTAIN double iodides of mercury with other metals are dimorphic and exhibit a more or less pronounced color change at the transition point, says a writer in a leading chemical journal. He has made a study of these in order to determine which compounds are most suitable for use as visible indicators of over-heating in bearings and machinery.

The double iodide of silver and mercury, $AgI.HgI_2$, is a pale lemon yellow powder at ordinary temperatures, but changes to a vivid carmine at 90 to 100 degrees C., the change in both directions being fairly sharp. With copper mercuric iodide, $Cu_2I_2.2HgI_2$, the change from a vivid scarlet vermillion to a chocolate brown takes place at 60 to 70 degrees C. It was found that a mixture of the two, consisting of 85 per cent of the copper salt and 15 per cent of the silver salt, was more sensitive and gave an exceedingly sharp transition from vermillion to almost black at 60 to 70 degrees C.

For application to bearings, etc., these compounds are mixed with white shellac spirit varnish or, for more elevated temperatures, a medium such as is used in aluminum paints for steam pipes, in the proportion of 100 g. compound to 70 cc. of medium. This paint is best applied as a bullseye or band on a zinc white background. After the paint is dry, it should be protected with a coat of colorless oil-proof varnish.

The Microscope in War

FEW persons are aware how large a part the microscope has come to play in chemical analysis; more particularly in the identification of materials. During the war the most important work in this direction was the analyses of defective explosives, primers, and other munitions of the Allies, as well as of the materials found in captured German shells and duds. By the micrometric measurement of powder grains, etc., it was often possible to report the efficiency of explosives, which is largely dependent upon the size of the particles.

A pocket case eight inches long will carry as many as 60 little reagent tubes for microscopic work and, as can be readily understood, the chemist can operate with much smaller amounts of material with the microscope than he can without it. Indeed, if the problem has to do, for instance, with the nature of an enemy primer, the very small amount of material under the primer cap usually restricts analysis to this instrument.

Many bodies are determined by their crystalline forms and both solids and liquids are often recognized by their refractive indices. Many poisons are identified by the same method. There are almost always a considerable number of suicides in battle, some from shooting and others from poisoning. The presence of the suspected poison in the stomach indicates the latter.

Many alloys are examined to discover their content and the same may be said of fuses. Clothing of all sorts, balloon fabrics, paper cloth, captured sand bags and paper tape for carrying shells were examined to arrive at a sense of conditions in Germany. Food was under constant test to find out whether it had gone bad or not, or was adulterated.

The increased use of the microscope in progressive laboratories as compared with 20 years ago would surely surprise many an old-timer.

Iron Ore and Coal in China

THE iron industry in Shansi is the oldest in the world. The ore is, unfortunately, in irregular lenses, the average thickness being about one foot. Mining this ore by modern large-scale methods is therefore impossible, although much of it can and is mined by native methods. The estimated quantity in Shansi is 300,000,000 tons, although this quantity is necessarily approximate. In other parts of China there is approximately 300,000,000 tons more, of which at least half can be worked by modern methods. In 1915 the total production of pig-iron was about 300,000 tons. Of this amount, 136,541 tons came from the Hanyang Iron Works and 29,529 tons from the Sino-Japanese Coal Co., at Penshihu. The rest came from small native furnaces in various parts of China. Besides supplying the Hanyang works, the Tayeh mine exported 298,350 tons of ore to Japan. The estimated total production of pig-iron in 1918 is 500,000 tons. The iron-ore deposits are now controlled by either Chinese or Japanese interests, the Chinese government making efforts to obtain control of deposits not already mortgaged to the Japanese.

Manufacturing Paper Yarn and Fabrics

THE manufacture of yarns and fabrics from paper has made remarkable progress in Germany during the war, owing, of course, to the shortage of jute, flax and cotton, resulting from the Allied blockade measures. Commencing with the production of coarser yarns suitable for making sacks, sandbags, twine, etc., the process of manufactures has been improved so that fine yarns, from which underlinen, bed sheets, upholstery materials and many other fabrics of a similar nature, are now being made from paper.

The question of the success or failure of paper fabrics depends not so much upon the production of the yarns, as on the treatment of the paper necessary to improve its wearing properties, and to render it proof against the effect of moisture. Untreated paper is a weak, unstable material, and merely to twist a strip of it into a round thread will not add greatly to its capacity to resist wear or moisture. Hence the necessity for impregnating the yarn, without which the paper would dissolve into pulp if allowed to remain wet for any length of time. The problem thus seems to be one for the industrial chemist rather than for the spinner or manufacturer, and to what extent it has been solved may be judged from the fact that a paper undergarment of German manufacture felt quite soft, and appeared to be as good as new after having been washed 16 times. The Germans, however, guard their trade secrets with the greatest possible care, and neutral agents who have endeavored to acquire information as to the process of manufacture of such goods, have met with little or no success.

The so-called "spinning" of paper yarns presents no very great difficulties, and although special machines are made for the purpose, ordinary cotton-spinning machinery, modified for the purpose, is largely employed. Actually the process consists of twisting a narrow, flat strip of paper into a round thread, and roving frames are generally employed for the coarser "counts," and ring spinning frames for the finer ones. Machinery normally

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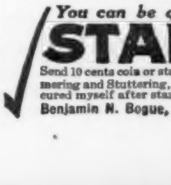

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used for making fish-net yarns can, with very little alteration, be used for twisting paper. For all machines the principal alteration required is to the creel, which must be made to hold the paper strips rolled up into the form of disks; the twist gearing must also be altered to give the right amount of twist. In using ring frames, however, the question of the shape and weight of the traveler is a source of trouble.

Sweden, it is understood, is now preparing to manufacture paper goods, and having regard to that country's supplies of raw material in the form of pure cellulose paper, she should be in a particularly good position to take up the industry. Swedish manufacturers have obtained some small amount of information from Germany, and they are now carrying out the necessary alterations to a number of cotton-spinning machines, while awaiting the delivery of cutting machines ordered from Germany. One Swedish firm is endeavoring to manufacture both cutting and spinning machines similar to those used in Germany, but has not yet been able to design a satisfactory substitute for the damping device, which is a German patent. The cutting knives are also a difficulty, since those on the German machines are hollow ground, and Swedish firms are, apparently, unable to do the necessary hollow grinding. Thus in Sweden but little progress has, as yet, been made with the industry, though several of the largest cotton-spinning firms are prepared to take up the manufacture of the coarser yarns for sacking, twine, canvas, and similar goods.

In Denmark practically nothing has yet been done, the position being that, while weaving firms are keenly interested in paper goods, the cotton spinners refuse to take the matter up for financial reasons, being doubtful whether paper yarns and materials will be able to hold their own in the textile market under normal conditions. Probably the position is somewhat similar in England, but one firm, the Textilite Engineering Company, Limited, of 36 and 37, Queen Street, London, E.C. 4, is now making yarn and twine of various sizes, as well as sacks and bags, stair coverings, wall coverings, webbings, and other goods of paper, by means of machinery made in this country under patents owned by the firm. Samples of their products on view at the British Scientific Products Exhibition, attracted considerable attention and appeared to be well suited to the purposes for which they were intended. So far as we are aware no washing fabrics of paper were exhibited, there apparently being no demand for such materials in this country, even under war conditions, and the demand is not likely to develop in normal times when ample supplies of cotton, flax and other textile materials will be available.

Ignition and Explosion

EXPLOSIVES like gunpowder, etc., are called propellants, or low explosives. They are set off by igniting them, and the explosion of these materials is really only a very rapid combustion. Explosives like guncotton, dynamite, etc., which detonate, are called disruptives, or high explosives. Many high explosives can be ignited and may burn completely up without exploding. When guncotton is ignited it burns with extreme rapidity. It is said that if a pinch of coarse grained black powder is placed on a small sheet of guncotton and the guncotton is lighted, it will burn out from under the powder so fast that the powder is not even lighted. I once heard of a chemical student who made a guncotton handkerchief by steeping his own hankerchief in the proper acids and then washing it out. This treatment did not alter its appearance at all, though of course it changed its chemical composition. Then he sent the handkerchief to the wash, and when the laundress went to iron it, she placed it on the ironing board and touched it with the hot iron, when—puff! It was gone, and so very quickly that she didn't even see it go. She looked all over the room for it, then didn't dare to tell the owner, for she actually had hold of it when it went. She really thought she was losing her mind.

Iron or Steel for House Drainage

IN order to decide on the merits of house drainage pipes of cast-iron, wrought-iron and steel and of their joints, etc., a New York engineer collected material in 78 of the principal buildings of Broadway, confining himself to buildings of six and more stories, and of more than five years of age, since more recent buildings would not afford much information as to corrosion. Thirteen of the buildings were over 30 years old, only six less than 10 years. In the older buildings cast-iron predominated, in more recent buildings pipes of steel and wrought-iron of the screw-jointed type (not caulked).

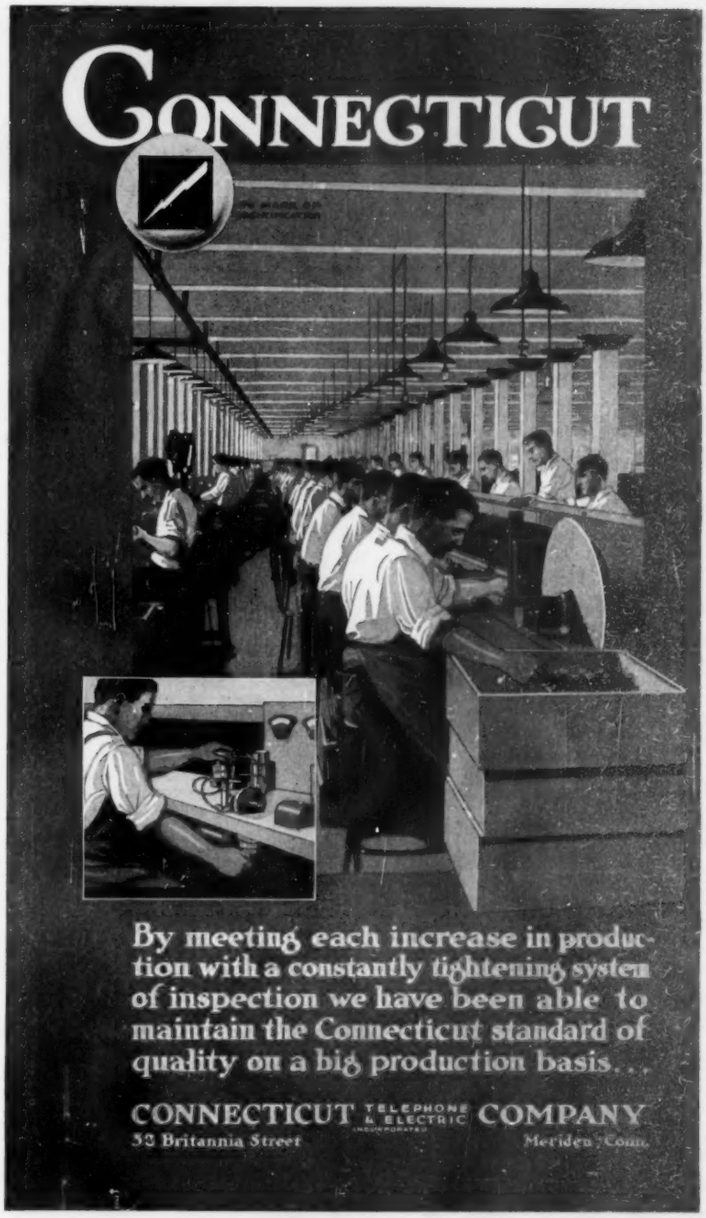
Particular attention was paid to the roof vent pipes, as they were likely to show the greatest natural corrosion; of the 1,076 vent pipes examined, one-third were cast-iron.

The tests on which this authority relied in his distinction of steel and wrought-iron and as to other features were the following: In the fracture test the pipe was hammered to the point of fracture; genuine wrought-iron should give a dull gray fibrous fracture; steel an even, bright, crystalline fracture; the zone of galvanized steel peels off in scales under the hammer, while it should stick to wrought-iron without cracking. In the threading test a thread was cut in the pipe; a wrought-iron pipe should give crumbling chips, steel a long spiral. Owing to corrosion wrought-iron becomes pitted and pock-marked; steel scales off; cast-iron also cuts uniformly. In the acid test the specimens were cleaned of grease and scale and then placed for 15 or 20 minutes in a cold mixture of water, sulfuric acid and hydrochloric acid in ratio 9:3:1; the fibrous structure of wrought-iron then should come out, while steel should dissolve uniformly. For the manganese test a chip was dissolved in warm picric acid, and to the cooled solution drops of sodium bismuthate were added, until a brown precipitate appeared, the pinkish color of the solution then indicated the presence of manganese which would be characteristic of a steel; wrought-iron should not give a pink-solution as manganese is not used in its preparation. This test, Gerhard admits may be misleading; his other tests might also be questioned perhaps, but he submitted doubtful cases to further tests.

Finally, he performed a microscopic test after etching the specimen with picric acid; wrought-iron would then show fibres of silicate slag, while steel would show pearlite in fairly even distribution. From his investigations he concluded that cast-iron is satisfactory from the corrosion point of view, but unsatisfactory with respect to the caulked joints which are apt to turn leaky. Direct joints are superior, provided the pipe could be well screwed into the shoulder of the fitting; exposed portions of the thread should be protected against external corrosion. As regards steel and wrought-iron pipes, genhine wrought-iron appeared undoubtedly the more durable material.

Glucinium-Aluminum Alloy

THESE two metals are combined in nature in the form of the double silicate, which constitutes the emerald. They are capable in the metallic state of forming alloys exhibiting remarkable properties. By incorporating one to five per cent of glucinium with aluminum an alloy is produced which is more resistant and harder than aluminum and which readily fuses. It resists atmospheric agents excellently and its density is lower than that of aluminum by five to 30 per cent, according to the composition. Consequently it deserves attention from the makers of airplanes.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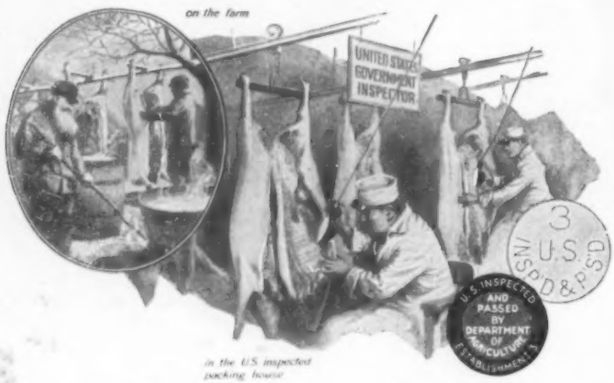
on the farm
UNITED STATES GOVERNMENT INSPECTOR
U.S. INSPECTED AND PASSED BY DEPARTMENT OF AGRICULTURE ESTABLISHMENT 3
in the U.S. inspected packing house

American meat-dressing—yesterday and today

Look at the left-hand picture above. It is typical of the old-time meat-dressing methods.

In the old days meat-dressing was purely a local business. There were one or more abattoirs in every city and town, and in the villages and on the farms most families did their own meat-dressing.

There was no scientific knowledge of sanitation and refrigeration, no ambitious study of meat-dressing methods and no adequate and intelligent system of animal and meat inspection.

* * *

The development of centralized packing organizations like that of Swift & Company brought big improvements in meat-dressing methods.

Thousands of travelers who yearly visit the packing plants in Chicago are impressed with the high state of cleanliness.

But equally important is the rigid care exercised in the inspection of animals. Only animals such as are sound and healthy reach your table as meat from the "U. S. Inspected" packing plants.

* * *

All packers doing an interstate business work under the supervision of the government.

Note the picture above to the right. This shows federal experts inspecting dressed pork. Every piece of meat that comes from Swift & Company's packing plants bears the O. K. of the U. S. government.

If America's meat industry were still a local unorganized business, inspection of meat would be out of the question.

Today, because of the development of the nation's packing industry to its present form and because of the rigid U. S. government inspection, American meat is the cleanest and healthiest in the world.

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NEW BOOKS, ETC.

FIGHTING THE FLYING CIRCUS. By Capt. Eddie Rickenbacker. New York: Frederick A. Stokes Company 12mo.; 371 pp.

Encounters in the air constitute the most thrilling and romantic part of modern war; we are all eager to know the sensations and emotions of those steel-nerved men who did so much to place America at the front in this style of fighting. Here our ace of aces, Rickenbacker, tells what his "Hat-in-the-Ring" Squadron did toward putting Von Richthofen's flying circus out of business; besides recounting the personal experiences of this noted airman, the book reviews America's part in aerial warfare and forms a vivid chapter in the history of the great conflict.

MEXICO UNDER CARRANZA. By Thomas E. Gibbon. New York: Doubleday, Page and Company. 12mo.; 270 pp.

A lawyer, with a lawyer's sense of what constitutes proof, bears witness against the violation of Mexico by Carranza. The case is logically and dispassionately presented from evidence collected on the ground. We are told why the Pershing expedition failed, and are shown that this continuous disturbance at our very doors is part and parcel of our own national problems. We may be in a better position to feel toward its solution after hearing what this eye-witness has to say.

WHAT WE EAT. And What Happens To It. By Philip B. Hawk, Ph.D. New York: Harper and Brothers. 12mo.; 232 pp.

After long years of neglect and mistaken ideas, the subject of human nourishment is receiving some of the attention that is its due. Dr. Hawk rests his findings upon what is probably the most painstaking and far-reaching series of experiments that has yet been made. He answers many of the questions we are asking as to the use and effectsof ice-water, coffee, and otherdrinks, candy, oleomargarine, foods, and food-combinations, and shows us that intelligently applied knowledge is as important in the matter of what we eat as it is in business, art, and ethics.

SELECTIONS AND ESSAYS. By John Ruskin. Edited, with anintroduction, by Frederick William Roe. New York: Charles Scribner's Sons. 12mo.; 423 pp.

It it a pity that Ruskin is not more widely read by the present generation. With a remarkably sure grasp of the needs of labor, the elements of taste, and the essentials of true art, his essays are always readable and uplifting. This volume of The Modern Student's Library brings together selections that may well open up a rich field to the reader; it is part of a commendable effort to place the classics within reach of those who cannot afford expensive editions of standard authors.

A SECOND BOOK OF COMPOSITION. For High Schools. By Thomas H. Briggs and Isabel McKinney. Boston and New York: Ginn and Company, 1919. 12mo.; 516 pp.

The method and the treatment here developed make composition a very practical study. Prefaced by a clear explanation, the lessons build up in the student mind sound ideas of argument and debate, journalism, the short-story, and letter-writing. The themes it uses are closely concerned with the work-a-day world, but there is no lowering of the literary standard and, better still, the common error of seeking to reduce the various forms of literary effort to formulas is avoided.

CLEANING AND RENOVATING AT HOME. By E. G. Osman. Wilmette, Ill.: Home Economy Book Company, 1919. 12mo.; 217 pp.

This is a household manual well calculated to meet all the emergencies that call for cleaning, dyeing, or restoration. Dry cleaning, the removal of stains of all kinds, the renovation of clothing and fabrics, and the cleaning of furs, gloves, and jewelry, are presented in numerous recipes and the plainest of instructions.

THE OTIS GROUP INTELLIGENCE SCALE. Yonkers-on-Hudson, N. Y.: World Book Company, 1919.

This is a point scale for the measurement of native mental ability, for use with either young or old subjects who have had at least three years of schooling. The outfit consists of examination sheets, individual record cards and log slips, an examiner's key, and a manual of instructions. The tests, based chiefly upon the alphabet and simple words in brief sentences call for normal powers of observation and memory. The procedure is at once ingenious and sensible, and the scale will be of benefit to schools and in industry where conditions are not always favorable to strictly individual tests.

EXAMPLES IN MAGNETISM. For Students of Physics and Engineering. By Prof. F. E. Austin, B. S., E. E. Box 441, Hanover, N. H.: F. E. Austin, 1919. 12mo.; 90 pp.; illustrated.

The fundamental mechanical actions of magnets and magnetic fields are presented by the author as a series of short lessons for beginners. Trigonometric relations, functions, and solutions are set forth as simply as possible and further clarified by abundant cuts and diagrams. The problems have been selected with judgment, and all tend toward the establishment of accurate and logical thinking.

THE TRAFFIC FIELD. Chicago: LaSalle Extension University, 1919. 8vo.; 299 pp.; illustrated.

A very little study of our national transportation problem will convince us of the extreme importance of traffic management; it means much more than rate-quoting and claim-handling, as those who would make this their profession may learn from this excellent text. A true conception of the scope of the problem is formed for the student and everyday situations are informingly discussed. Various sections of the work deal with the industrial traffic department, associated, community, and railway traffic management, and public utility commission work; each section has been prepared by an authority in his own particular field.

REPORT OF THE PROGRESS AND CONDITION OF THE UNITED STATES NATIONAL MUSEUM. For the Year Ending June 30th, 1918. Washington: Government Printing Office, 1919. 8vo.; 174 pp.; illustrated.

More interesting than ever, the annual report shows how the Museum has demonstrated its value as a national asset during the war. To its work in geology, physical anthropology, textiles, foods, and photography, the Government is indebted for vital aid, as is the case also in problems arising from gas warfare, ship construction, and other matters. The report describes at some length the activities of the various departments and divisions; there is a list of recent accessions, and another of the Museum's publications for the year.

HIDDEN TREASURE. The Story of a Chore Boy Who Made the Old Farm Pay. By John Thomas Simpson. Philadelphia and London: J. B. Lippincott Company, 1919. 8vo.; 303 pp.; illustrated.

The transformation of an old-fashioned farm into a prosperous and delightful home is the theme of this book; that the material is cast into fictional form detracts nothing from the value of the practical pointers it conveys. The gradual evolution from drudgery to comfort through a boy's constructive imagination and optimistic energy is well told, and both boys and mature readers with the love of the soil in their blood will find the characters worth meeting and the facts and figures worth learning.

THE AMERICAN AIR SERVICE. By Arthur Sweetser, Sometime Captain, Air Service, U. S. A. New York and London: D. Appleton and Company, 1919. 8vo.; 384 pp.; illustrated.

We have eagerly taken advantage of such glimpses of war aviation as have been allowed us; now we have the complete story. It was planned that the airplane was to have been America's supreme contribution toward victory. Among the big problems confronting us were the training of flyers and ground forces, the quantity production of motors, and the perfection of airplane construction. The author deals skillfully with the development of the situation and with its insurmountable difficulties. The chapters delineating the actual work at the front and the heroic activities of our flyers and balloon men will command the absorbed attention of the reader. The introduction by the Secretary of War endorses the work highly and brings a deserved tribute to our intrepid "soaring soldiers."

SHORE PROCESSES AND SHORELINE DEVELOPMENT. By Douglas Wilson Johnson. New York: John Wiley and Sons, Inc., 1919. 8vo.; 584 pp.; illustrated.

This needed contribution by the Associate Professor of Physiography in Columbia University endeavors to pilot geologists and geographers into a common harbor of understanding as to the fundamental principles at the back of changes of level; as conclusions are arrived at, their applications to this problem are crisply made plain; it is the intention of the author to use these deductions and principles in a later work to be entirely occupied by the moot question of coastal subsidence. In the meantime we may profit by this orderly exhibition of the results of shoreline studies at home and abroad, and by Professor Johnson's skillful analyses and shrewd criticisms.

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